

# Building the Foundation for the Next 50 Years of Exploration.



2008 NASA Education Highlights



## building the foundation

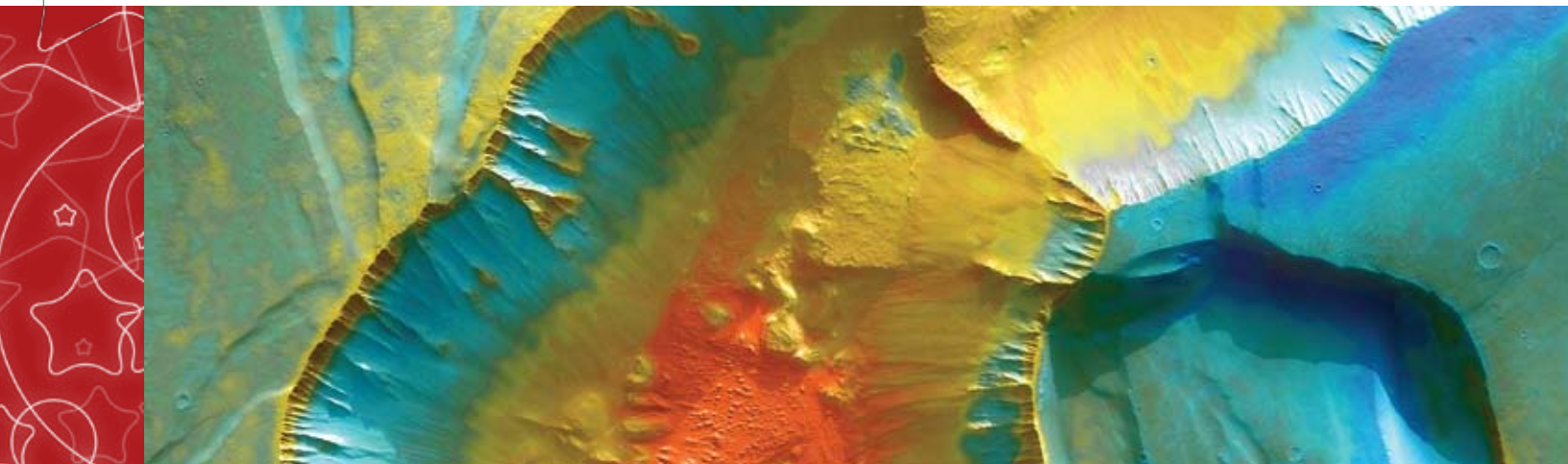
"I submit that one of the most important roles of government is to motivate its citizens, and particularly its young citizens, to love to learn, and to strive to participate in—and contribute to—societal progress."

—Neil Armstrong, NASA Astronaut

Read about the innovative ways NASA is creating new activities that spark the interest and imagination of people from all segments of society.

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As NASA celebrates the past 50 years of innovation, the Agency continues its commitment to support today's education community and provide compelling STEM experiences that inspire tomorrow's explorers.





October 2008

## A Message from the Assistant Administrator for Education



This year, NASA celebrates 50 years of exploring various frontiers that have led to new horizons of opportunity. As NASA implements the U.S. Space Exploration Policy, carrying humans back to the Moon, on to Mars, and beyond, the Agency is also working to lay the educational groundwork that will make this ongoing journey possible.

As the Agency furthered its efforts to contribute to the Nation's future science, technology, engineering, and mathematics (STEM) workforce, we continued to engage Americans in NASA's mission in an unprecedented way. In the summer of 2007, Mission Specialist Barbara R. Morgan captured students' imaginations as an Educator Astronaut who flew to space aboard the Space Shuttle Endeavour on an assembly mission to the International Space Station (ISS). In 2008, we continued to reap the "space harvest" of space-exposed basil seeds from this flight by engaging over one million students in the Engineering Design Challenge. In early 2009, Mission Specialists and Educator Astronauts Ricky Arnold and Joe Acaba will journey to the ISS and perform spacewalks during mission STS-119. NASA is planning exciting education activities around the mission.

Another historic space flight will occur in 2009: the final Hubble Space Telescope servicing mission. Once more the STS-125 Space Shuttle Atlantis mission will push the boundaries of how deep in space and far back in time humanity can see. The crew of seven astronauts will upgrade what already may be the most significant satellite ever launched, and NASA is making plans to engage students, educators, and the informal education community with the key scientific breakthroughs and awe-inspiring images Hubble already has provided. We will showcase the increased capability of this tremendous resource that will result in untold new knowledge and opportunities to inspire future explorers.

On the ground, NASA's Space Grant College and Fellowship Program is bringing space to communities nationwide through student rocket and satellite launch activities. This document highlights several of these talented students who are studying to become future leaders in space exploration, and the faculty who are guiding their journey.

As we commemorate this milestone of the Space Age, NASA continues to attract and retain students in STEM disciplines. Our newest Elementary and Secondary Education project, the Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE), is seeking out the Nation's most talented students and bringing them to NASA Centers to learn alongside the Agency's scientists and engineers. Informal education institutions, such as the new Sudekum Planetarium in Nashville, Tennessee, are helping our Nation's youth learn about the wonders of space, and our place in the universe.

Through content and activities based on its compelling missions, NASA is supporting the education of the next generation of Americans. By making Federal agencies, nonprofit organizations, industry, community, and educators partners in our efforts, we are finding new ways to inspire the next generation to study challenging STEM subjects and prepare to follow their dream of exploring the cosmos.

We invite you to join us in celebrating NASA's legacy and pursuing a greater tomorrow. Together we can build the innovative workforce that will redefine the pinnacle of exploration excellence for future decades.

Cordially,

A handwritten signature in black ink, reading "Joyce L. Winterton". The signature is fluid and cursive, with a long horizontal line extending from the end.

Dr. Joyce L. Winterton  
NASA Assistant Administrator for Education

# NASA Education Overview

NASA is taking a leading role in the effort to inspire interest in science, technology, engineering, and mathematics (STEM)—as few other organizations can—through its unique mission, workforce, facilities, research, and innovations. NASA is continuing to pursue three major education goals: strengthening NASA’s and the Nation’s future workforce, attracting and retaining students in STEM disciplines, and engaging Americans in NASA’s mission.

## NASA Education Programs

**Higher Education** focuses on strengthening the research capabilities of the Nation’s colleges and universities as well as providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by these institutions contributes to the research needs of NASA’s Mission Directorates. The student projects serve as a major link in the pipeline for addressing NASA’s Human Capital Strategies and the President’s Management Agenda. The projects help to “build, sustain, and effectively deploy the skilled, knowledgeable, diverse, and high-performing workforce needed to meet the current and emerging needs of government and its citizens.”



**Minority University Research and Education** engages underrepresented populations through a wide variety of initiatives. Multiyear grants are awarded to assist minority institutions, faculty, and students in research pertinent to NASA missions. The program focuses on recruiting and retaining underrepresented and underserved students in STEM disciplines through completion of undergraduate or graduate degrees in support of their entry into the scientific and technical workforce.



**Elementary and Secondary Education** projects provide K–12 educators with tools, experiences, and opportunities to further their education. Students participate in unique NASA learning experiences that enhance their knowledge of STEM and inspire the pursuit of STEM careers. The program supports the role of educational institutions, providing the framework to bring together students, families, and educators for educational improvement.



**Informal Education** inspires learning by educating students, educators, and the general public on specific STEM content areas, resulting in the expansion of the Nation's future STEM workforce. Projects within the program produce supplemental education materials that are standards-based and support life-long learning in the STEM fields. Self-directed learners and education professionals are engaged through NASA-themed, hands-on activities.



**Education Technology and Products** are on the horizon and will enable new learning environments using simulations, visualizations, immersion, online game playing, intelligent tutors, learner networking, e-Professional Development (e-PD), digitized building blocks of content, and more. The goal is to leverage multimedia-rich products and technology infrastructures to deliver exploration-related content to audiences while partnering with NASA's Mission Directorates, professional education organizations, and others to create effective learning experiences and connections for a range of audiences.



## NASA Education Management

**NASA Office of Education** administers national education efforts that draw on content from across the Agency. The Office of Education is responsible for ensuring compliance with external requirements and laws and NASA-wide processes, procedures, standards, audits, and accounting related to education. It also provides the leadership for coordinating and integrating NASA's Strategic Education Framework, implementation approach, and policies.



**NASA Mission Directorates** each cover a major area of the Agency's research and development efforts. The Mission Directorates and other NASA Headquarters organizations that fund education efforts are responsible for embedding education components into their research and development programs and flight missions, administering the discipline-/content-specific activities for which they provide funding and resources, and ensuring meaningful collaboration between the NASA science/engineering community and the education community.



**NASA Centers** are responsible for institutional assets and the execution of components of the Agency's numerous and varied research and development programs across the Nation. Center Education Offices implement NASA education projects and activities for the Mission Directorates and the Office of Education, as well as planning and implementing education programs that are unique to, and funded by, their Centers.



*Please see Appendices for more information about NASA Education.*



## Inspiring the Next Generation During NASA's 50th Anniversary

As NASA celebrates 50 years of innovation, the Agency is highlighting its contributions and value to the Nation and its citizens across the country. Accordingly, beginning in January 2008, NASA traveled nationwide hosting Future Forums in key cities. NASA leadership, astronauts, scientists, and engineers along with local business, technology, and academic leaders accompanied by local, State, and Federal officials met to discuss the role of space exploration in advancing science, engineering, technology, education, and the economy.

The program featured an exciting preview of NASA's Constellation Program—America's return to the Moon and beyond. Using the inspirational pursuit of space exploration to spark the imagination of our youth is crucial in keeping the Nation competitive in developing the workforce that will achieve our future exploration missions.

The Future Forums occurred in Seattle, WA; Columbus, OH; St. Louis, MO; Miami, FL; San Jose, CA; Boston, MA; and Chicago, IL. The forums featured an "Innovation" panel which focused on business and technology; a "Discovery" panel that discussed science, research, and applications; and an "Inspiration" panel focused on education.

The "Inspiration" panels discussed how to best engage students of tomorrow, exploring ideas that ranged from classroom practices to recruitment and retention efforts. The events facilitated informative discussions on how best to enhance interest and performance in STEM and related careers, reinforce

individuals' creativity and ability to become innovators in today's workforce, and prepare students to solve future problems as members of the aerospace workforce.

## Engaging the Education Community in NASA's Missions

As NASA celebrated its milestone year by highlighting the achievements of the past five decades, the Agency also engaged key individuals in brainstorming on ways to increase collaboration with the education community. NASA has hosted several education forums that coincided with Agency mission activities at NASA's Kennedy Space Center (KSC). Education leaders interacted with NASA regarding the Agency's education goals and programs, and also received exclusive access to NASA facilities, mission preparation and briefings, and historic launches of the Space Shuttle.

In October 2007, leaders from both traditional and innovative engagement programs in industry and academia met to share their ideas on means of identifying talented K-12 and higher education students, securing their interest in STEM coursework, and drawing them into the STEM workforce. High school and undergraduate students offered their opinions on how the Agency can better connect with them and use new technology to make Agency activities even more relevant and accessible to today's youth. The forum concluded with viewing of the October 23rd STS-120 launch of Space Shuttle Discovery on an assembly mission to the International Space Station (ISS).

Approaches to attracting young Hispanic scientists and engineers into the Agency's STEM education projects and better collaboration with the Nation's Hispanic Serving Institutions





were discussed by leaders in industry and academia during an STS-122 prelaunch forum in December 2007. In February 2008, participants viewed the launch of Space Shuttle Atlantis and its crew of six astronauts to ISS.

University presidents, chancellors, and deans of colleges of engineering and education participated in a session on how to better prepare new graduates to enter the STEM workforce in the forum, “A Dialogue Between University Presidents and NASA Education” held on May 30-31. The event focused on enhancing NASA Education’s relationships with colleges and universities, and included viewing of the launch of the STS-124 mission to deliver components of the Japanese Kibo laboratory on ISS.

Strategies to harness the public’s interest in Hubble Space Telescope (HST) imagery were discussed during a prelaunch education forum entitled, “Using the Power of Hubble to Inspire the Next Generation of Explorers” in October 2008. Leadership from the Nation’s museums, science centers, and informal institutions convened for a forum based on the historic final mission to service HST, with STS-125. The forum focused on the educational benefits of the mission that would once more push the boundaries of how deep in space and far back in time humanity can see, and again upgrade what already may be the most significant satellite ever launched. The STS-125 launch of Atlantis was scheduled for October 10, 2008.

These unique events, which will continue through 2009, capitalize on the excitement of NASA’s missions while formulating methods to ensure that the young minds of today will be similarly inspired to lead the Nation’s innovation of tomorrow.

## Federal Collaboration for Future STEM Competitiveness

NASA is actively collaborating with agencies throughout the Federal Government in an effort to shape STEM education nationwide.

The NASA Office of Education represents the Agency on the Interagency Aerospace Revitalization Task Force, a group of Federal agencies with a vital interest in strategic planning for STEM education to address the declining numbers of individuals entering careers in STEM and strengthen the science and

technology workforce. Signed into law in 2006, the Task Force is chaired by the Assistant Secretary of Labor for Employment and Training and works to maximize the cooperation and use of resources among Federal departments and agencies, develop integrated Federal policies to promote and monitor public and private sector STEM programs and skilled trades education and training, and establish partnerships with industry, organized labor, academia, and State and local Governments.

Education is an active member of the National Science and Technology Council (NSTC) Education Subcommittee and Evaluation Subgroup. The work of the subcommittee has helped NASA identify rigorous evaluation methodologies for determining the effectiveness of programs, and implement the recommendations of the Academic Competitiveness Council. The NSTC is conducting a comprehensive inventory of STEM education programs and documenting program successes and lessons learned.

In 2006, NASA asked a range of Federal agencies with responsibilities in education to participate in the International Space Station (ISS) Education Coordination Working Group charged with developing a strategy for using the ISS, the largest and most complex space vehicle ever built, as an educational asset. Planned for completion in 2010, the space station will provide a home for laboratories equipped with a wide array of resources to develop and test the technologies needed for future generations of space exploration. “An Opportunity to Educate: ISS National Laboratory,” presents a plan to validate the task force’s strategy for using ISS resources and accommodations as a venue to engage, inspire, and educate students, teachers, and faculty in the STEM areas. Information about current NASA and non-Agency programs aimed to increase STEM achievement is included in the report. For the demonstration phase of the plan, eleven organizations submitted varied candidate demonstration projects which cover STEM subjects and convey the possibilities inherent in the ISS National Laboratory concept. In Spring 2008, the document was finalized and submitted to Congress.



## Smithsonian Folklife Festival

The recent 400th anniversary at Jamestown reminds us of this Nation's foundation in exploration and innovation, with discoveries throughout history culminating in the Space Age. As NASA celebrates its own 50-year milestone, we embody the Americans who benefit from, and contribute to, our mission.

Over a million Americans including teachers, parents, students, families, and summer/informal education groups, were able to experience and celebrate NASA at the 42nd annual Smithsonian Folklife Festival held June 25–29 and July 2–6, 2008. NASA was one of three featured programs on the National Mall in Washington, DC, and provided exhibits and activities that connected the public with the thrill and legacy of human exploration. "NASA: Fifty Years and Beyond" showcased the role that the men and women of NASA have played in broadening the horizons of American science and culture, as well as their continued role in helping shape the future.

Each year, the Smithsonian Folklife Festival celebrates the cultural traditions of communities across the U.S. and around the globe. NASA showcased its contributions to the culture and history of this country and the world through hands-on educational activities, demonstrations of skills and knowledge, narrative "oral history" sessions, and exhibits that explored the spirit of innovation, discovery, and service embodied by the Agency and its personnel.

Exhibit areas included Kids' Space, Space Art, NASA-derived Technologies, Aeronautics, Propulsion, Earth Science, Human Space flight: Future Initiatives, and Space Science. NASA education personnel from the Office of Education (OE), Mission Directorates, and Centers supported this event on-site and remotely. NASA Stennis Space Center (SSC) and Astro Camp

displayed a Space Shuttle Main Engine (SSME) and a J-2 engine, fired the miniature hybrid "pocket rocket" to demonstrate the principles of propulsion, and provided hands-on children's activities that included Space Shuttle docking and rocket transportation.

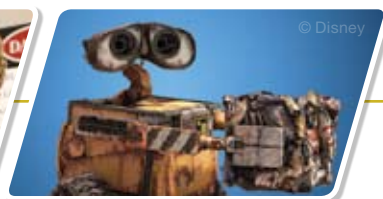
## Congressional Direction for New Education Programs for 2008

In response to congressional direction, NASA announced in July 2008 three new competitive funding opportunities that could result in the awarding of grants or cooperative agreements. These solicitations will address innovative opportunities for informal, elementary and secondary, and higher education institutions.

One of the three funding opportunities is the K-12 Competitive Grants Opportunity, an education grant project targeting secondary school level teaching and learning, with grants being awarded to U.S. public schools and nonprofit organizations. The goal of the opportunity is to seek out and support new, innovative, and replicable approaches to improving STEM learning and instruction.

The second area is the Global Climate Change Education Opportunity. The goal of this project is to improve the quality of global climate change and Earth system science education at the elementary, secondary, and undergraduate levels. Each funded proposal is expected to take advantage of NASA's unique contributions in climate science to enhance students' academic experiences and improve educators' abilities to engage and stimulate their students.

In the third area of opportunity, NASA is making available funding for science museums, science-technology centers, and



planetariums to enhance programs related to space exploration, aeronautics, space science, Earth science, or microgravity.

## Collaborating with Entertainment/Media Industry to Inspire

As the Agency continues to pursue its three goals that will foster our future workforce, it entered into groundbreaking multimedia relationships that have the potential to inspire youth and the general public in an unprecedented way.

**Buzz Lightyear Blasts Off to ISS.** The popular 12-inch action figure from Disney's *Toy Story* films, Buzz Lightyear, flew to space aboard Space Shuttle Discovery on the STS-124 mission on May 31, 2008, as Disney Parks and NASA launched the Space Ranger Education Series. The series was part of NASA's Toys in Space educational program. The series was available throughout the year.

Buzz Lightyear is spending several months in space at the International Space Station (ISS), testing the limits of microgravity. While in space, Buzz is participating in zero gravity experiments, and appears in a video downlink from the ISS. Tentative plans for Buzz's return included a back-to-school initiative and possibly a hero's welcome at Walt Disney World in Florida later in 2008.

**Disney-Pixar Goes to Space.** NASA also teamed with Disney-Pixar regarding *WALL-E*, a unique computer-animated film that opened in theaters nationwide to critical acclaim on June 27, 2008. NASA and Disney worked together to create a series of educational and public outreach activities based on the similarities between the movie's storyline and NASA's real-life work in robotics technology, propulsion systems, and astrophysics.

With NASA's Digital Learning Network (DLN), *WALL-E* served as a guest host to help NASA teach students about the Lunar Reconnaissance Orbiter (LRO) satellite mission to the Moon; LRO is NASA's first step toward returning humans to the Moon and is scheduled to launch in the fall of 2008. The robotic spacecraft will orbit the Moon, and its six different instruments will capture images and gather information about the Moon's surface.

Through videoconferencing and live Web casts, DLN modules bring NASA content into the classroom; *WALL-E* also made a special appearance in a robotics DLN episode.

## Improving Performance through Evaluation

NASA's success in implementing its education programs is dependent on the ability of the Agency to achieve desired outcomes. To document and demonstrate progress toward these goals, NASA Education has made evaluation, assessment of performance, and reporting data a priority.

Evaluation is conducted so that managers can determine the worth or merit of an activity or project against its stated objectives. This often includes an assessment of its actual effectiveness and impact. Evaluation allows NASA to be certain that its education programs are well-managed, are meeting the needs of its audiences, and are communicating the importance of the Agency's missions. The evaluation process guides decision-making and funding allocation; it is also critical to identifying areas of success and needed improvement. External reviews and evaluations, as well as internal processes and controls ensure that projects are performing at or above expected levels.

In managing its education projects, NASA collects and uses data to establish baselines for performance—a standard against which future efforts can be compared. Data analysis and use of data as indicators of performance measure progress toward meeting established education goals. Internally, this use of data aids in improving the return on the Agency's investment in education, including meeting and exceeding expectations, project reach, cost, schedule, customer satisfaction, project quality, and relevance. When reported externally, such as through the Office of Management and Budget's (OMB) Program Assessment Rating Tool (PART), the data demonstrate results and show accountability for the use of Federal funds.

New tools are in development by NASA's Office of Education that will enable standardized user surveys and data gathering, aid in assessing project performance, and improve the efficiency of reporting results. In addition, a five-year contract for conducting independent evaluation of NASA education projects has been awarded.

These efforts to determine the effectiveness, efficiency, and impact of NASA education programs enables NASA to better manage them, and improve progress toward achieving Agency education goals.



# Higher Education Overview



## Meeting Future Workforce Needs

The Office of Education is strengthening involvement with institutions of higher education to ensure that NASA can meet future workforce needs in the STEM fields. Participation in NASA programs and research stimulates students to continue their studies at all levels of the higher education continuum and earn advanced degrees in these critical fields. Through a portfolio of project types, the NASA Higher Education activities seek to increase the overall capacity at all levels of universities and colleges to better address STEM disciplines related to NASA.

## Higher Education Strategy

Specifically, projects are in place to build connections—through partnerships and consortium awards—that provide institutions of higher education and other educational entities better bridges for students, provide fellowship and scholarship opportunities to attract “the best and the brightest” students to NASA disciplines, catalyze institutional development to improve the ability of colleges and universities to compete for NASA research awards, increase the candidate pool of qualified faculty who can compete for NASA research awards, and facilitate improved coordination between NASA-sponsored university research activities and teacher preparation projects to expose teachers-in-training to NASA research and discoveries, thus furthering their understanding of STEM disciplines.





## Examples of Higher Education Projects

Higher Education focuses on strengthening the research capabilities of the Nation's colleges and universities as well as providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by these institutions contributes to the research needs of NASA's Mission Directorates. The student projects serve as a major link in the pipeline for addressing NASA's Human Capital Strategies and the President's Management Agenda. The projects help to "build, sustain, and effectively deploy the skilled, knowledgeable, diverse, and high-performing workforce needed to meet the current and emerging needs of government and its citizens."

**The Experimental Program to Stimulate Competitive Research (EPSCOR)** develops academic research enterprises that are long-term, self-sustaining, and nationally competitive by supporting states with modest research infrastructure to become more competitive in attracting research funding. Funding is awarded to lead academic institutions, fostering a STEM relationship with industries for research and development opportunities.

**The Graduate Student Researchers Project (GSRP)** cultivates research ties to the academic community to help meet the continuing needs of the Nation's aeronautics and space effort. This project seeks to increase the number of

highly trained scientists and engineers in aeronautics and space-related disciplines and to broaden the base of students pursuing advanced degrees in STEM. Fellowships are awarded for graduate study leading to master's or doctoral degrees in the STEM fields related to NASA research and development. [Managing Center: KSC]

**The National Space Grant College and Fellowship Program (Space Grant)** is a national network of colleges and universities that works to expand opportunities for Americans to understand and participate in NASA's aeronautics and space programs by supporting and enhancing science and engineering education, research, and public outreach programs.

**The Undergraduate Student Research Project (USRP)** is NASA's largest Agency-wide internship program. USRP offers immersive, STEM experiences for college sophomores through seniors. USRP internships are available during fall and spring semesters (15 weeks) or the summer (10 weeks) and allow students to work full-time in a challenging, "hands on" technical environment that relates to their field of study. USRP students are placed with NASA scientists and engineers at all the NASA Centers across the U.S. These nationally competitive, highly regarded internships help to prepare and enable students to become members of NASA's future workforce. [Managing Center: JSC]



## Students Navigating the Moonscape

Each year around April, a half-mile of paths at the U.S. Space & Rocket Center in Huntsville, Alabama are transformed into a harsh lunar landscape. The course tested the engineering savvy and physical endurance of about 400 high school and college students on 68 teams for NASA's 15th annual Great Moonbuggy Race 2008.

The students, hailing from 20 states, along with Puerto Rico, Canada, India, and Germany, raced lightweight moonbuggies they designed based on the original lunar rovers used during the Apollo 15 Moon mission in 1971. They faced 17 unique course obstacles—built of plywood and old tires—that were covered with 20 tons of gravel and 5 tons of sand and shaped into Moon-like ridges, craters, sandy basins, and lava-etched “rilles.”

The race challenged students to design a vehicle that addresses a series of engineering problems similar to those faced by the designers of the original Apollo-era lunar rover. The basic challenge—maximizing durability while minimizing mass—may apply to future lunar vehicles.

Student innovators from the University of Evansville (Evansville, IN), sped past 23 teams from around the country and globe to win the college division of the race. Finishing in the top three along with Evansville were second-place winners from Murray State University (Murray, KY), and third-place racers representing Canada's Carleton University (Ottawa, Ontario).

## Virtual Reality Improves Rocket Engine Testing

Graduate Student Researchers Project (GSRP) student George Lecakes and Rowan University (Glassboro, NJ) have been prototyping a virtual reality interface so that test stand operators can view an entire system through geometric models and sensor data visualizations.

During the Apollo program, the Saturn V rocket engines that propelled astronauts to the Moon were tested on Stennis Space Center's A-1 test stand. The same test stand—with updated technology—was used to certify Space Shuttle main engines and is now being used for preliminary testing on the Constellation Program's developing J-2X engine. Integrated Systems Health Management was incorporated, which uses an array of intelligent sensors, root-cause analysis software, and a visual operator interface to understand, manage, and identify faults and anomalies in the system.

Integrating data into a virtual environment and converting it into simple visualizations allows an operator to quickly grasp a situation and simultaneously monitor several different variables. Large data sets can be integrated, assimilated, and quickly viewed. Lecakes's visualization system will enhance the Integrated Systems Health Management by providing the ability to navigate rocket test information quickly and competently while searching for anomalous conditions.



## A New Vision for NASA Internships

The NASA Undergraduate Student Research Project (USRP) is evolving by making innovative changes to capture the interest and imagination of NASA's future technical workforce. In 2008, USRP became NASA's largest year-round internship project, placing 315 students from across the U.S. in semester- or summer-long immersive technical experiences. To keep in pace with its computer-savvy audience, USRP has developed an online application that is fully electronic and has simplified the process of applying. As a result, USRP received nearly 3,000 highly qualified applicants, placing a record number of students for internships at NASA Centers.

USRP project management software, "USRP Connect" was also developed to allow NASA mentors to electronically browse and rank the significant number of USRP applicants to select the best match for their projects. USRP Connect then allows the project to notify students electronically of their selection through "e-offers," which reduce the turnaround time for acceptances. USRP Connect has promoted new efficiency and better matching capabilities between NASA mentors' needs and students' skill sets, making for a better overall internship experience.

In 2008, USRP launched a new "Find Your Vision" outreach campaign aimed to attract students in the technical core disciplines needed by NASA so they can visualize themselves as being part of NASA's future missions. Initiatives were put in place that included higher levels of connectivity to recruit students and build community between students and mentors within USRP.

## NASA Higher Education Super Student Flies High

University of Arizona senior Yuridia Robeson is an exceptional example of NASA's efforts to involve students in a progression of education opportunities that prepare them for NASA-related research and careers, as well as engage underrepresented populations.

Robeson, a Hispanic female, grew up in the small border town of Douglas, Arizona. "I was not prepared for college and did not

know what to expect once I was accepted so I chose the school closest to home," she said.

Robeson's choice to attend the University of Arizona (UA) paid off as she found mentor-guided research through the prestigious University of Arizona/NASA Space Grant Internship. "Once I got the NASA grant, everything seemed possible," she said. With encouragement from the Space Grant manager, in 2006 Robeson applied and was accepted into the Massachusetts Institute of Technology Summer Research program. In 2007 Robeson won the NASA MUST (Motivating Undergraduates in Science and Technology) Scholarship and its associated summer internship at NASA Johnson Space Center (JSC). She is also a part of the UA's Ronald E. McNair Post-baccalaureate Achievement program, which is designed to prepare participants from underrepresented and underserved populations for doctoral studies through involvement in research and other scholarly activities. Dr. Ronald Erwin McNair was a physicist and one of NASA's first African-American astronauts. He died in 1986 aboard the Space Shuttle Challenger.

During summer 2008, Robeson participated in the NASA Robotics Academy at NASA Goddard Space Flight Center (GSFC) in Maryland, a highly prestigious summer program that selects only 12 to 15 applicants nationwide to study areas of research of high importance to NASA's space program. She was given special permission for a short leave of absence from the intensive summer robotics academy to head for NASA JSC in Houston with a team of UA and University of Florida students to conduct scientific research aboard NASA's modified McDonnell Douglas DC-9 jetliner that takes 45-degree nosedives to simulate microgravity. The team's flight is part of NASA's Reduced Gravity Student Flight Opportunities Program. Robeson's proposal entails characterizing the properties and testing the resiliency of an ionic polymer metal composite that she hopes has possible merits for replacing heavier materials that are currently used for space operations. Robeson's experiment on the ionic polymer metal composite in zero gravity has never been tested in space. The Student Flight Opportunities Program provides students with experience in scientific research, hands-on experimental design, test operations, and educational and public outreach activities and requires six months of preparation and nine days on site.



Space Grant activities across the country are paving the way for student innovation and success. For the past 13 years, through a grant provided by NASA and the Oklahoma Space Grant Consortium, Oklahoma State University students have been competing in the designing, building, and flying of remote-controlled airplanes as part of the aerospace engineering curriculum.

Oklahoma State University aerospace engineering professor Andy Arena and students in the university's mechanical and aerospace engineering program raised the bar in 2005 and began designing airplanes to compete for world records. Since then, Arena's students have broken three world records and are planning to break more.

This feat was significant because the previous record set by a team from Switzerland in 1998 of 10 hours, 38 minutes and 30 seconds stood for 9 years.

Space Grant is a national network of colleges and universities supporting and enhancing science and engineering education, research, and public outreach efforts. The project supports NASA's goal of strengthening the Agency's and the Nation's future workforce.

The launch of university faculty and student-built experiments aboard a NASA Orion sounding rocket from Wallops Island, Virginia, was the highlight of the RockOn! workshop in June 2008. During the week-long event, coordinated by Colorado and Virginia Space Grant Programs, participant teams learned the basics of building experiments for flight on suborbital rockets, and then used kits developed by students from the Colorado Space Grant Consortium to construct their experiments. In the early morning of June 27, the rocket flew to an altitude of approximately 41 miles. After launch and payload recovery, participants conducted data analysis and discussed their results. Nearly 60 people from universities in 22 states and Puerto Rico participated. Eighty percent of the team members were faculty who will use the lessons learned through RockOn! to make flight experiments a part of the educational process at their home institutions.





## JPFP Surpasses Ph.D. Production Goal Two Years Early

When the NASA Harriett G. Jenkins Predoctoral Fellowship Project (JPFP) launched in the year 2000, a goal was set that by the year 2010, the JPFP would place 50 Ph.D. recipients into the STEM workforce. In July 2008, this goal was officially met. Just eight years after its inception, JPFP scholars have earned a total of 50 doctoral and 35 master's degrees. In this short time period, the project has supported 151 outstanding scholars and is highly recognized as one of the most prestigious federally funded fellowship programs in the United States. Another significant accomplishment has been realized: all JPFP Ph.D. recipients are employed within the STEM industry, with 11 of them working at NASA.

The NASA JPFP plays a pivotal role in the advancement of underrepresented persons in STEM disciplines by providing funding and research opportunities for young graduate students. To date, 17 percent of JPFP participants are employed by NASA, 20 percent in academia, 20 percent in the aerospace industry, 15 percent in other Government, and 25 percent in other industry. It is clear that in the next decade, JPFP alumni will continue to serve as major contributors to NASA and the Nation's STEM workforce.

## Students Create Operations Improvement Plan for KSC Facility

A research project by a team of graduate students from Purdue University may help improve the future of human space flight. The students researched communication between engineers and technicians at NASA Kennedy Space Center (KSC) for their winning entry in the NASA Exploration Systems Mission Directorate (ESMD) annual systems engineering paper competition.

The team's paper presented a plan to improve the exchange of information inside the Vehicle Assembly Building at KSC, by establishing an easy-to-implement and inexpensive way to present information to technicians. In this immense facility, the Space Shuttle is prepared for launch, including stacking the external tank, the solid rocket boosters, and the orbiter together and preparing the assembled Space Shuttle for rollout to the launchpad.

The premise of the students' paper is the importance of effective communication between engineers and technicians as new vehicles are built and current facilities are modified. Current Vehicle Assembly Building procedures for the assembly, integration, and maintenance of launch vehicles are compiled into paper manuals and kept in large, three-ring binders. Purdue students evaluated the issues associated with using paper manuals and explored whether the use of portable electronic devices could improve operations.

The students researched and developed the paper under the direction of Barrett Caldwell, an industrial engineering professor at Purdue and director of the Indiana Space Grant Consortium. The Indiana Space Grant Consortium is part of NASA's National Space Grant College and Fellowship Program, which funds research, education, and public service projects through a national network of university-based consortia.

Students funded by ESMD for a senior design project, and teams participating in other approved competitions, are invited each year to submit a systems engineering paper about their project for the ESMD systems engineering paper competition. The competition supports NASA's goal of strengthening the Agency's and the Nation's future work force.

# Minority University Research and Education Overview



## Diversity in Higher Education

The Office of Education is strengthening involvement with higher education institutions to ensure that NASA can meet future workforce needs in STEM fields. Participation in NASA projects and research stimulates increasing numbers of students to continue their studies at all levels of the higher education continuum and earn advanced degrees in these critical fields.

NASA strives to ensure that underrepresented and underserved students participate in Agency education and research projects to assist more of these students in their pursuit of STEM careers. The Higher Education Program will continue to focus on the Minority University Research and Education Program (MUREP), thereby enhancing the capabilities of Historically Black Colleges and Universities' (HBCU), Hispanic Serving Institutions' (HSI), and Tribal Colleges and Universities' (TCU) contributions to the research needs of science and technology enterprises. In addition, the Office of Education encourages these institutions to collaborate with teacher preparation programs that improve the quality and diversity of STEM teachers.

## Examples of Minority University Research and Education Projects

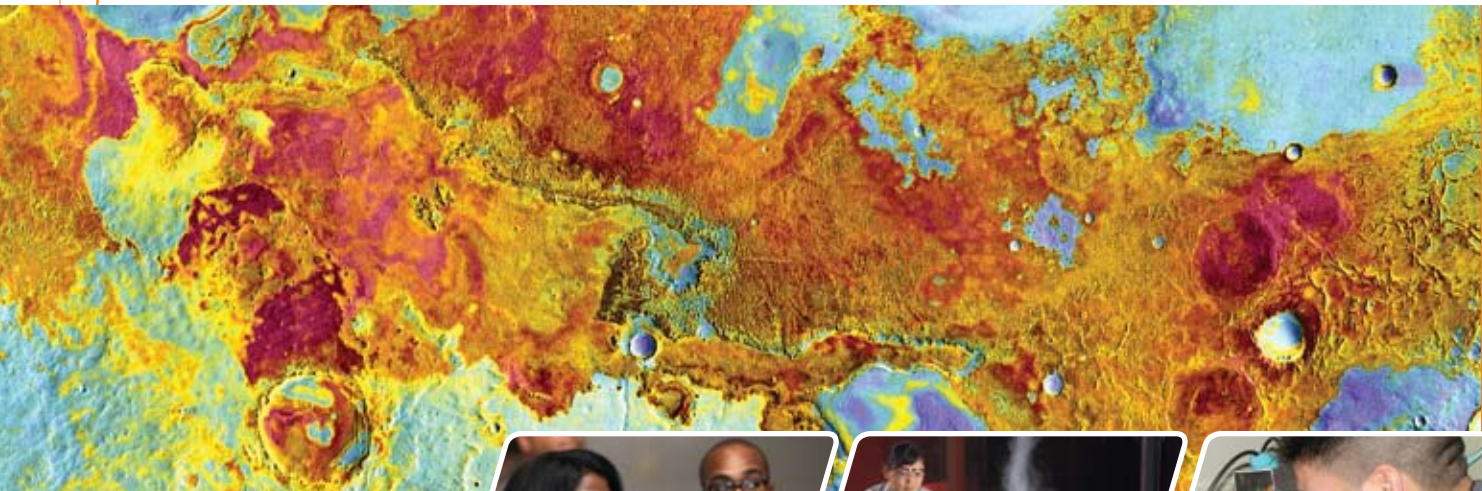
Minority University Research and Education engages underrepresented populations through a wide variety of initiatives. Multiyear grants are awarded to assist Minority Institutions (MI), faculty, and students in research pertinent to NASA missions. The program focuses on recruiting and

retaining underrepresented and underserved students in STEM disciplines through completion of undergraduate or graduate degrees in support of their entry into the scientific and technical workforce.

**Motivating Undergraduates in Science and Technology (MUST)** provides partial scholarships (renewable up to three years) to undergraduate students (rising freshmen, sophomores, juniors, or transfer students) to support up to 50 percent of tuition and fees. Students who have accumulated 30 credits or more will be offered an additional stipend of \$5,000 to participate in an internship at a NASA Center related to their current field of study. [Managing Center: GRC]

**Curriculum Improvement Partnership Award for the Integration of Research (CIPAIR)**, a three-year undergraduate curriculum improvement program for MIs, including Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges and Universities, and other MIs, emphasizes improvements that are directly related to the NASA mission by infusing innovative learning experiences in STEM into the curriculum. [Managing Center: JPL]

**NASA Science and Technology Institute for Minority Institutions (NSTI-MI)** provides leading-edge research opportunities for faculty and students from MIs that complement NASA's research programs and make original contributions to NASA in astrobiology, biotechnology, information technology, and nanotechnology. Faculty and students from MIs collaborate with the scientists at NASA Ames Research Center, industry,



academia, and nonprofit organizations on research that helps prepare the next generation of explorers for NASA missions. [Managing Center: ARC]

**Jenkins Predoctoral Fellowship Project (JPFP)** provides support for underrepresented and underserved students in STEM disciplines, including women, minorities, and those with disabilities who seek advanced degrees and opportunities for NASA-related research. The ultimate goal is to facilitate the development of a more inclusive, multicultural, and sustainable STEM workforce. [Managing Center: ARC]

**NASA Administrator's Fellowship Project (NAFP)** seeks to increase the ability of MIs to respond to NASA's overall research and development mission. To that goal, NASA employees spend a year visiting faculty/administrators at MIs and members of MIs' STEM faculty spend a year conducting research at a NASA Center. [Managing Center: MSFC]

**University Research Centers (URC) Project** provides a broad-based, competitive NASA-related research capability among the Nation's MIs that fosters new aerospace science and technology concepts, expands the Nation's base for aerospace research and development, develops mechanisms for increased participation by faculty and students of MIs in mainstream research, and increases the production of U.S. citizens who have historically been underrepresented in NASA-related research and in obtaining advanced degrees in STEM disciplines. [Managing Center: DFRC]

**Tribal Colleges and Universities (TCU) Project** responds to Executive Order 13270, Tribal Colleges and Universities, which directs Federal agencies to provide support to Tribal College faculty and students. NASA partners with TCUs to increase student and faculty involvement in activities related to space exploration and technology. The partnership enhances the capacity of TCUs to compete for Federal grants and resources, and provides high-quality educational opportunities to Native American students and faculty. [Managing Center: KSC]

**MUREP Small Projects** support a variety of opportunities for students, teachers, faculty, and researchers from underrepresented and underserved communities in NASA-related STEM fields. [Managing Center: KSC]

MUREP Small Projects include:

- **Achieving Competence in Computing, Engineering and Space Science (ACCESS)** provides summer internships to highly qualified students with disabilities. Students work for 10 weeks during the summer with a NASA mentor in either a lab or office environment.
- **Preservice Teacher Conference** has provided hands-on training and seminars for several hundred prospective elementary and middle school teachers from Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges and Universities, and select majority institutions.





### Michael P. Anderson Summer Outreach Project: Hands-on Learning About Engineering Careers

The Michael P. Anderson Summer Outreach Project was hosted for a second year by the Alabama A&M University School of Engineering Technology. Michael Anderson was an African American NASA astronaut who died in 2003 during the Space Shuttle Columbia accident. The project is designed to engage underserved minority high school students in engineering and science and introduce them to technical careers through a three-week intensive session of engineering design challenges and mathematics instruction. Students from 12 high schools participated and competed for awards in robotics, bridge building, Web page design, land surveying, and mechanical assembly. The sessions were taught by NASA scientists and engineers and Alabama A&M University professors. Students visited the U.S. Space and Rocket Center, which is the official visitor center of NASA Marshall Space Flight Center (MSFC), and area aerospace industries. The goal of the project is to inspire students to attend college and pursue STEM careers.

### Historically Black Colleges and Universities (HBCU) K-12 Student Launch Experience

Grants were awarded to four HBCUs to bring inner-city youth—participating in a University K-12 program—to KSC for an education workshop, tour, and possible launch viewing.

The selected universities were Morgan State University (Baltimore, MD), North Carolina A&T State University, Prairie View A&M University (Prairie View, TX), and Tennessee State University. The project focuses on raising student awareness of the importance of STEM and aerospace careers. Activities included: an overnight experience at the Apollo/Saturn V Center, a NASA KSC museum featuring an actual multistage Saturn V rocket used by NASA's Apollo and Skylab programs; a hands-on STEM-related workshop; a tour of KSC's Visitor Center and Epcot, a theme park at the Walt Disney World Resort dedicated to international culture and technological innovation; and opportunities to interact with NASA engineers, scientists, and astronauts.

This initiative meets the Agency's challenge of building strategic partnerships between NASA and secondary schools in order to ensure a more seamless progression of academic opportunities for underserved and underrepresented students.

### Partnership with Tribal Colleges and Universities (TCU)

A pilot project, the TCU Summer Research Experience (SRE) Institute, was developed by NASA GSFC and the American Indian Higher Education Consortium (AIHEC) and tested with 20 students during summer 2008. The project intends to collaborate with TCUs to bring NASA resources and experiences to Native American communities and accommodate the students' and faculties' need to be closer to home.





NASA solicited TCU student-faculty teams to visit United Tribes Technical College in Bismarck, North Dakota for three weeks in June and participate in a full program to orient the teams to science and NASA in a cultural context. NASA provided briefings on a variety of disciplines, including astronomy, Sun-Earth, Earth Sciences, Space Science, and teaching to Native American audiences. Courses were given on subjects such as Geographic Information Systems, remote sensing, the scientific method, climate change, mapping, business, and performance expectations. Participants began a research project during the initial three weeks at the institute under the supervision of mentors from NASA, Tribal Colleges, and the aerospace industry.

Following the three weeks at the institute, the students and faculty returned to their colleges and continued their research for seven weeks. At the conclusion of the research, teams presented their findings via videoconferencing at the Tribal College Forum in August and at AIHEC conferences. By the end of the summer, the students gained enough experience to facilitate their participation in research activities at a NASA Center for the following summer/year.

### HBCU Leads NASA Mission To Explore Clouds at the Edge of Space

Hampton University in Hampton, Virginia is the first HBCU to lead a NASA space mission, and has responsibility for development and mission control. The Aeronomy of Ice in the Mesosphere (AIM) satellite mission was designed to explore Polar Mesospheric Clouds (PMC)—also called noctilucent clouds—to find out why they form and why they are changing. Results from this mission will provide the basis for study of long-term variability in the mesospheric climate ultimately leading to a better understanding of climate change.

Hampton University competed against major universities to win this \$140M award. Dr. James M. Russell, III, professor and codirector of Hampton University's Center for Atmospheric Sciences (CAS), is AIM's principal investigator. Under Russell's direction, Hampton University is responsible for the entire mission and assisting him is an international science team along with Hampton University faculty, staff, and students.

AIM has been selected for extended mission funding following the two-year Explorer baseline mission. The extension from June 2009 through September 2012 will allow tracking of the evolution of mesospheric clouds to continue for an additional seven seasons. In May 2008, the AIM team received a NASA Group Achievement Award "for outstanding achievement in developing and launching the Small Explorer mission to study the phenomena of polar mesospheric clouds."

The program also continues to lead national education activities for teachers and students. AIM hosted a high school student activity in Alaska to see and learn about noctilucent clouds.

### HESTEC Participants Learn About Working and Living on Mars

Hispanic Engineering Science and Technology (HESTEC) is an annual event organized by the University of Texas-Pan American (UTPA) in conjunction with the Office of Congressman Rubén Hinojosa (TX-15). Congressman Hinojosa is the Chairman of the Higher Education, Lifelong Learning, and Competitiveness Subcommittee of the House Committee on Education and Labor.

HESTEC is a year-round program that promotes STEM careers among predominantly Hispanic South Texas students.

During HESTEC Week 2007 in late September 2007, events were held for educators, students, and their families that focused on "Inspiring the Next Generation of Explorers." NASA workshops engaged educators in STEM enrichment activities related to robotics, STS-118, and future space exploration. NASA also featured an exhibit that focused on living and working on Mars which displayed Mars Exploration Rovers, a Mars meteorite, and a lunar sample. Students rotated through the exhibit and participated in hands-on activities with NASA scientists and engineers. NASA invited the public to explore its exhibit during HESTEC Community Day, an event that attracted over 85,000 visitors. Astronaut Lee Morin signed autographs, while students built habitats for living on Mars, worked with robotic arms, and viewed Mars terrain using 3-D glasses.



## A Partnership to Expand the Research Agenda at Minority Serving Institutions

The fourth Minority Serving Institutions Research Partnerships (MSIRP) Conference, hosted by Dillard University in New Orleans, LA, provided a venue for more than 500 NASA, industry, and academia participants to discuss avenues to advance the research capacity and infrastructure at Minority Serving Institutions (MSI). One such avenue is through the NASA University Research Centers (URC) project, which has resulted in the establishment of 21 multidisciplinary scientific, engineering, and/or commercial research centers at MSIs over its 16-year history. After a six-year hiatus, the NASA URC solicitation will yield five new cooperative agreements at five million dollars over five years by the end of 2008.

During a preconference workshop, 25 MSIs participated in a unique collaboration between the URC project and the MSFC Office of Small Business Programs, which set the stage for academia to identify potential partnership opportunities in NASA-related areas of interest with 17 of NASA's current prime contractors in a special matchmaking session. These partnerships will strengthen the research agendas at MSIs as well as strengthen the STEM workforce for NASA and the aerospace community for years to come.

## NASA Science and Technology Institute (NSTI)

The NASA Science and Technology Institute (NSTI) was established in June 2006 with capital funds from NASA Higher Education for the main purpose of providing leading-edge research opportunities for faculty and students from MSIs and MSIs. The NSTI Research Clusters and student internships support the NASA research agenda and the development of next generation of explorers. NSTI faculty and students are strongly encouraged to pursue applied research and to establish collaborations with NASA scientists, industry partners (such as those resident in the NASA Research Park, Silicon Valley, California), academia, nonprofit organizations, and other Federal agencies.

Launched at Google headquarters in 2006, the NSTI has placed three research clusters at NASA facilities. Selected following a competitive process, the clusters are currently conducting research at Ames Research Center (ARC), Glenn Research Center (GRC), Johnson Space Research Center (JSC), and their home institutions. The three research clusters are Information and Emerging Technologies Research Cluster, Energy and Environmental Research Cluster, and The Mission Enabling Technologies Research Cluster.



NSTI has administered successful summer student internships that supported 44 students over the last 3 years. Many of the NSTI summer interns are pursuing advanced degrees through other NASA programs.

### From MUST Scholar to KSC Co-op

Brittani Sims was among 100 students selected to become part of NASA's first group of Motivating Undergraduates in Science and Technology (MUST) Scholars. The MUST project provided her with academic resources, a partial tuition scholarship, and most significantly a summer research experience at a NASA Center. Out of ten Centers to choose from, Brittani chose to spend her 10-week experience at NASA KSC in Cape Canaveral, Florida. She arrived at KSC in June 2007, and was assigned to work at the Cape Canaveral Spaceport Management Office (CCSMO) in the Integration (Technical) Office. As a CCSMO intern, Brittani was assigned a research project that consisted of analyzing preventive maintenance and unscheduled power outages on critical launch facilities. Throughout her 10-week experience, Brittani displayed exceptional professional talents, work ethic, and enthusiasm. As a result of her contributions during the summer internship, Brittani was then accepted into the NASA KSC Cooperative Education Program.

As co-ops, students alternate semesters in school with semesters at NASA Centers. Students work in positions directly related to their field of study; receive enhanced academic knowledge; participate in a diverse, paid work experience; apply classroom theory in a practical, real-world environment; and gain a great opportunity for full-time employment after graduation. NASA education aims to inspire, engage, educate, and employ the diverse, talented STEM workforce of the future;

Brittani Sims is a great example of the program's positive impact through a progression of opportunities.

### JPFP Propels Students to New Heights

The Jenkins Predoctoral Fellowship Project (JPFP) plays a pivotal role in the advancement of minorities in STEM disciplines, opening important pathways to NASA employment. As of 2008, 11 JPFP alumni are supporting the NASA mission as part of the workforce at NASA Centers and facilities.

Ravi Prakash is one of those scholars. Without the encouragement of his roommate at Georgia Tech, also a JPFP fellow, Prakash may never have applied.

He did, however, and during his time in JPFP Prakash received a master's degree in aerospace engineering, an instrumental milestone in his career. Prakash recalls that the fellowship gave him the chance to lead trade studies and apply what he had learned in college.

Prakash has worked at NASA JPL for three years, and supports the Mars Science Laboratory (MSL) Entry, Descent, and Landing (EDL) design. He is excited by his work field-testing MSL's radar in the desert, on a helicopter, and on an F-18. "Every day that I am at JPL, I learn a ton, and these new skills should help me even more along the way," said Prakash.



# Elementary and Secondary Education Overview



## Preparing the Next Generation

NASA is taking bold steps at the K–12 grade levels to prepare the next generation of explorers. Building on previous accomplishments, NASA has established a series of innovative programs designed to stimulate student interest in order to motivate higher levels of study in STEM subjects.

These activities provide unique learning experiences for students, teachers, administrators, and families. NASA strives to ensure that underrepresented and underserved students participate in education programs, thereby encouraging more of these students to pursue STEM careers. NASA is also working to develop new digital media methods that will make NASA's exciting discoveries and missions available to K–12 students and educators.

## Examples of Elementary and Secondary Education Projects

NASA Elementary and Secondary Education projects provide K–12 educators with tools, experiences, and opportunities to further their education. By participating in unique NASA learning experiences, they enhance their knowledge of STEM, which increases their ability to inspire students to pursue STEM careers. These activities support the role of educational institutions, providing the foundation to bring together students, families, and educators for educational improvement.

**Aerospace Education Services Project (AESP)** serves the elementary and secondary education community by providing professional development, classroom demonstrations, faculty workshops, parent training, in-service training for teachers, and identification of appropriate classroom resources. [Managing Center: LaRC]

**NASA Explorer Schools (NES)** establishes partnerships between NASA and school teams, consisting of teachers and education administrators from diverse communities across the country. The project is designed for education communities at the 4–9 grade levels to help middle schools improve teaching and learning in STEM education through significant educator resources and curricular support materials based on NASA content. [Managing Center: GRC]

**Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE)** is a multitiered project for students and their parents or legal guardians. Participating students must be in grades 9–12 or in their freshman year of college. INSPIRE is designed to provide grade-appropriate NASA resources and experiences to encourage and reinforce students' aspirations to pursue STEM education and careers. INSPIRE maximizes student participation and involvement in STEM, and enhances the STEM pipeline from high school (grades 9–12) into the undergraduate level. The first INSPIRE students were involved with NASA Centers in the summer of 2008. [Managing Center: KSC]





**Science Engineering Mathematics and Aerospace Academy (SEMAA)** reaches K–12 minority and underserved students that are traditionally underrepresented in careers involving STEM. Students meet during school, after school or on Saturday mornings, and during the summer to engage in hands-on, interactive learning sessions that are specifically designed for each grade level. [Managing Center: GRC]

**\*Education Flight Projects (EFP)** develops and provides NASA-unique education experiences, opportunities, content, and resources to K–12 educators and students. EFP engages students and educators via hands-on experiences and participation in research applications on board NASA flight platforms, including the International Space Station (ISS), Space Shuttle, and Sub-orbital Flight Platforms. Activities include ISS Earth Knowledge Acquired by Middle School Students (EarthKAM), Amateur Radio on the ISS (ARISS), ISS in-flight education downlinks, and on-orbit education activities. The project builds internal and external partnerships with formal and information education communities to create learning opportunities and professional development experiences. [Managing Center: JSC]

**\*Educator Astronaut Project (EAP)** facilitates education opportunities that use the unique and exciting environment of space flight. The project develops and provides NASA experiences, opportunities, content, and resources to educators to increase K–12 student interest and achievement in STEM

disciplines. EAP facilitates the Network of Educator Astronaut Teachers (NEAT), a group of highly motivated K–12 educators, and provides professional development and support for the group. The project infuses content and advanced technological tools based on human space flight into K–12 education. [Managing Center: JSC]

**K–12 Competitive Educational Grant Program** awards grants to public schools and nonprofit organizations on a competitive basis. The goal of the solicitation is to seek out and support new, innovative, and replicable approaches to improving STEM learning and instruction. [Managing Center: TBD]

*\*Educator Astronaut Project was recently merged with Education Flight Projects*



### Educators Learn About the Power Driving Space Travel

Eighteen NASA Explorer Schools (NES) educators from NASA Centers across the United States traveled to NASA Stennis Space Center (SSC) to participate in “Propulsion: Power Behind Space Travel,” a week-long, interactive, inquiry-based NES content workshop focused on propulsion, Newton’s Laws, and the future of space exploration. Educators enthusiastically engaged in a multitude of content activities, technology sessions, tours, and interactive lectures, all of which used NASA educational materials. Content briefings were designed to teach best-practice educational lessons and reinforce NASA concepts. Technology workshops focused on using and implementing podcasting and the NASA Classroom of the Future (COTF). NASA-sponsored COTF served as the space agency’s principal research and development center for educational technologies.

All aspects of the workshop were well received, but a few highlights proved to be unforgettable for the educators. SSC Director and former astronaut, Robert Cabana, discussed space travel and how SSC fits into the plan for the future of space exploration. The week ended with the educators witnessing the shake, rattle, and roar of a Space Shuttle main engine test. These educators undoubtedly have vivid and lifelong memories of the extreme power that makes space travel possible.

### NASA Explorer Schools Compete In LEGO Robotics Match

In February 2008, student teams from 12 local elementary, middle, and high schools set their self-created and software-enabled LEGO robots against the clock in the second annual Southern California NASA Explorer School Robotics Competition at NASA Jet Propulsion Laboratory in Pasadena, CA.

Each team consisted of four students, and the contest had two divisions for elementary school teams and middle and high school teams. Students built and programmed their LEGO robots over several months using laptop computers; this competition was designed to engage them in real-world STEM. The small robots had to correctly perform a variety of tasks within two minutes, including retrieving simulated planetary mineral formations and rescuing a stranded “Moon rat,” or small robot, on a simulated Mars surface.

The NASA Explorer Schools project is a three-year partnership between NASA and about 200 elementary and middle schools nationwide. JPL is the local NASA partner for 25 schools in Southern California.



## SEMAA Sites Collaborate on National Science Foundation (NSF) Grant to Develop NASA Astrobiology Curriculum

Science Engineering Mathematics and Aerospace Academy (SEMAA) sites at Tennessee State University (TSU), New Mexico State University, and the Miami-Dade County Public Schools are collaborating on a Discovery Research K–12 grant from NSF totaling \$300,000.

The NSF Discovery Research K–12 program seeks to enable significant advances in K–12 learning of the STEM disciplines through research, development, and implementation of innovative resources, models, and technologies for use by students, teachers, and policy-makers. Activities funded under this solicitation begin with a research question or hypothesis about K–12 STEM learning or teaching; developing, adapting, or studying innovative resources, models, or technologies; and demonstrating if, how, for whom, and why their implementation affects learning.

The SEMAA sites are working together to advance STEM education by pilot-testing high school curriculum in astrobiology based on NASA content, and conducting educational research on the project and its impact on underrepresented students. The Web-based curriculum, Astrobiology in the Secondary Classroom (ASC), includes hands-on science activities, computer simulations, and analysis of real-world NASA data. SEMAA students currently participating in the project are practicing authentic science inquiry while pondering the “big questions” of life on Earth. Once the pilot-testing and research phase is complete, the curriculum will be replicated at SEMAA sites nationwide.

The ASC curriculum was developed through a collaboration of the Minority Institution Astrobiology Collaborative, the NASA Astrobiology Institute, and educators and curriculum developers from TSU. Additionally, scientists from the Goddard Center for Astrobiology, the Carnegie Institute of Washington, and the Indiana-Princeton-Tennessee Astrobiology Initiative contributed to the curriculum development.

## INSPIRE Kicks Off at NASA Centers

INSPIRE is a multitiered student pipeline project that is designed to encourage students from the 9th through 12th grades to pursue STEM education and careers.

In March 2008, Oklahoma State University was awarded a grant to provide administrative services for the INSPIRE project student recruitment, online resources, logistics, and program evaluation. The INSPIRE project’s phased implementation began in summer 2008 with the offering of eight-week internships at each Center and JPL. A total of 153 students from 23 states and Puerto Rico were selected to participate.

During fall 2008, other components of INSPIRE were implemented beginning with an Online Community. The electronic community will provide students and parents with grade-appropriate information, activities, and educational modules containing NASA content relevant to courses being taught in school. During spring 2009, students in the Online Community will compete to participate in unique hands-on summer experiences, many hosted at the NASA Centers.

## NASA Hosts U.S. Department of Education’s Teacher to Teacher Workshop

Who can better provide support to teachers than other teachers? That’s the idea behind the U.S. Department of Education’s Teacher-to-Teacher Initiative. Through the initiative, free summer regional workshops around the Nation allow educators to share ideas for raising student achievement with their peers.

For the second consecutive year, JSC was selected to host a regional Teacher to Teacher workshop. The event took place on July 1–2 and over 250 teachers from across the country participated. Teachers participated in an array of activities including peer-discussion opportunities, JSC facility tours, and presentations by NASA educators regarding activities centered around the STS-125 Hubble servicing mission in Fall 2008 and the STS-119 mission in Spring 2009. As a special highlight, Astronaut John D. Olivas led a hands-on learning experience that focused on spacewalks—Extra Vehicular Activities (EVA) occurring outside of a craft orbiting Earth.





### What's for Dinner on the Moon?

Future explorers will need to grow food in order to inhabit permanent settlements on the Moon and Mars. NASA scientists anticipate that astronauts may eventually be able to grow plants on the Moon, and the plants could be used to supplement meals.

In anticipation of the need for research into lunar plant growth, NASA and the International Technology Education Association (ITEA), launched the NASA Engineering Design Challenge: Lunar Plant Growth Chamber. Elementary, middle, and high school students were invited to design, build, and evaluate lunar plant growth chambers—while engaging in research and standards-based learning.

Educators who complete the challenge with their students can request cinnamon basil seeds that flew into space on the STS-118 Space Shuttle mission. Students are comparing plants grown from both space-flown and Earth-based control seeds, and testing the designs of the lunar plant growth chambers. Currently, over a million students are participating in the challenge and over 57,000 packets of seeds have been distributed.

### Network of Educator Astronaut Teachers (NEAT) Members Fly on Weightless Wonder

The NASA Educator Astronaut Project teamed with JSC's Reduced Gravity Education Flight Project to provide an opportunity for K–12 Network of Educator Astronaut Teachers

(NEAT) members. Interested teams developed reduced gravity proposals through teamwork between teachers and students within the classroom. Each selected team was assigned a NASA technical mentor to assist them in integrating the project and related NASA materials into the classrooms.

Digital Learning Network events were used as an integral part of this opportunity to keep the students involved in the entire process. The first videoconference event included an introduction to microgravity and the Reduced Gravity Education Flight Project. Then, several months into the activity, students and teachers reconnected with NASA to present their hardware to the technical panel. A third connection was coordinated allowing teachers to follow up with their students in the classroom from Ellington Field immediately following their research flight. The teachers concluded by having their students analyze the collected data and conduct outreach events to share the experience with their local communities.

### NASA Competitions Challenge Students

To engage students in NASA's missions and encourage creativity, NASA has sponsored several STEM and aerospace competitions that provide unique learning experiences as well as a variety of highly desirable prizes and awards.

Administered by the X PRIZE Foundation in Fall 2007 under an educational grant from NASA and carrying the name of the late NASA astronaut, the Pete Conrad Spirit of Innovation Award



challenged high school students to create concepts that could accelerate the personal space flight industry.

NASA's Innovative Partnerships Program and Office of Education announced the NASA 50th Anniversary Essay Competition for middle and junior high school students during the 2007-2008 academic year. The essay competition challenged students to describe current and future benefits to their everyday lives from NASA aerospace technologies.

In Spring 2008, NASA's Exploration Systems Mission Directorate (ESMD), through Langley Research Center (LaRC) presented the NASA Lunar Art Contest for students in arts, science, and engineering to collaboratively engage in NASA's mission to return humans to the Moon by 2020. The contest was cosponsored by Christopher Newport University (Newport News, VA) and supported by the NASA Center for Educational Technologies.

In collaboration with the American Institute of Aeronautics and Astronautics (AIAA), ESMD also presented the second annual 21st Century Explorer Podcast Competition, which challenged students to create an audio or video recording conveying NASA's greatest exploration achievement.

NASA's Aeronautics Research Mission Directorate Fundamental Aeronautics Program presented a NASA Aeronautics Competition for high school students worldwide to develop papers during Spring/Summer 2008 that describe the passenger and cargo aircraft of the future.

Through these competitions, NASA has provided incentives and opportunities that involve the next generation in the Agency's compelling missions and attract them to STEM fields.

## NASA Selects Penn State to Lead National Education Initiative

NASA has selected the Pennsylvania State University's Center for Science and Schools in University Park to lead the Agency's Aerospace Education Service Project, a comprehensive educational program designed to reach out to all 50 states and U.S. territories.

The cooperative agreement has a maximum value of \$27.5M over five years.

The project is the longest-running K-12th grade effort in NASA's education history. Under the agreement, Penn State will use NASA's myriad educational assets to aid America's formal and informal education communities in promoting STEM.

A professional development project, AESP provides educators and students with tools, experiences, and opportunities to further their education through educator workshops, classroom demonstrations, parent programs, and classroom resources. The goal is to attract and retain students in STEM disciplines vital to the Nation's space program.

## Outer Space Base Students Engage in Real Space Dialogue

Students blasted their local libraries into orbit after completing Outer Space Base, a library series of space science events and activities in Tucson, Arizona. Nine- to thirteen-year-olds participated in a live educational downlink with NASA Expedition 17 astronaut, Greg Chamitoff aboard the International Space Station (ISS) on August 15, 2008. The Pima County Public Library is the first public library system to host an ISS downlink. The downlink also was a first for the State of Arizona.

Outer Space Base events are the product of a partnership between the library, NASA, the Lunar and Planetary Institute, and the Mars Education Program at Arizona State University, in Phoenix.

Participants engaged in a week-long series of hands-on activities, focusing on human space flight and NASA's exploration plans, in preparation for the event. Outer Space Base is celebrating the 50th anniversary of NASA by promoting STEM skills among students.

NASA's education downlinks support the Agency's efforts to encourage students to pursue careers in STEM fields. These events, made possible by the education office at NASA Johnson Space Center and its Teaching From Space project, use the unique experience of human space flight to promote and enhance STEM education.

# Informal Education Overview



## Education Beyond the Classroom

In the 21st century, people of all ages are accustomed to seeking knowledge and enriching their lives 24 hours a day, 7 days a week at home, at play, and in settings outside of formal learning. NASA seeks to enhance the capabilities of individuals and informal education communities by providing access to NASA staff, research, technology, information, and/or facilities; offering professional development opportunities for informal science educators; and facilitating collaborative partnerships between the informal and formal education communities.

The informal education communities include but are not limited to amateur astronomy groups, after-school programs, libraries, museums, science centers, planetariums, zoos, aquariums, and community groups. Informal Science Education provides stimulating experiences for STEM learning outside of formal classroom environments through media, exhibits, and community-based programming.

## The Informal Education Program Goals are to:

- Increase interest in and understanding of STEM disciplines by inspiring and engaging individuals of all ages
- Establish linkages between informal and formal education
- Stimulate parents and others to support student STEM learning endeavors by becoming informed proponents for high-quality, universally available STEM education





## Examples of Informal Education Projects

Informal Education inspires learning by educating students, educators, and the general public on specific STEM content areas, resulting in the expansion of the Nation's future STEM workforce. Projects within the program produce supplemental education materials that are standards-based and support life-long learning in the STEM fields. Self-directed learners and education professionals are engaged through NASA-themed, hands-on activities.

**Science Center, Museum, Planetarium Grants** will be used to enhance education programs related to space exploration, aeronautics, space science, Earth science, or microgravity. Funding will be awarded as grants—including cooperative agreements—to museums, science centers, and planetariums. [Managing Center: JPL]

**NASA Visitor Center** awards will be provided to NASA's visitor centers to enhance NASA STEM education activities, including exhibits, events, and materials. They will address one or more of the NASA Education Outcomes and align with NASA Education principles, and state or national standards.



### Girl Scouts: Alabama Space Day Event

NASA Marshall Space Flight Center (MSFC), in partnership with the Girl Scouts of America, hosts an annual “Alabama Space Day” each November at the U.S. Space and Rocket Center, the official MSFC visitor center in Huntsville, AL. This event is designed to inspire the participating Girl Scouts to explore STEM careers. Girl Scouts from around the region are engaged in activities designed to spark student interest in STEM-based fields of study. All participants are given the opportunity to spend a night at the U.S. Space and Rocket Center Habitat, which gives the girls an engaging space experience.

In addition, MSFC has also partnered with Girl Scout troops in Alabama to inspire girls to explore STEM through robotics and rocketry, particularly the For Inspiration and Recognition of Science and Technology (FIRST) LEGO League Robotics competition and Team America Rocketry Challenge. Girl Scout troops that have attended a NASA workshop have the opportunity to be sponsored by NASA to compete in local, regional, and national robotic or rocketry competitions.

### You’ve Been Sentenced, NASA!

NASA commemorated its 50th anniversary with the creation of an educational card game, “You’ve Been Sentenced!—NASA 50th Anniversary Special Edition.” NASA and McNeill Designs for Brighter Minds formed a partnership in April 2008 to create the NASA Add-On Deck. “You’ve Been Sentenced!” is a unique card game with the goal to create sentences from various words. The game contains a word deck of pentagon-shaped cards used to create the sentences during game play, and additional theme decks have been created to enhance the game.

The NASA 50th Anniversary Special Edition Add-On Deck contains words used in space exploration, as well as terminology from the past, current, and future explorers, missions, and programs. “You’ve Been Sentenced!” delivers a unique way to understand these terms that is both fun and memorable for students.

The purpose of this project is to build a strategic partnership among informal education providers, NASA visitor centers, community groups, formal educators, and families to promote literacy, particularly focusing in the areas of space and STEM. The game “You’ve Been Sentenced!” can be used in classrooms to aid educators in teaching curriculum based upon NASA mission content.



## The Beauty of Our Galaxy Up Close

The new Sudekum planetarium opened on June 2008 in Nashville, TN at the Adventure Science Center. The new hall has been in development for six years and was made possible in part through the NASA Office of Education.

At the center of the new Sudekum Planetarium is a 28-inch GOTO Chiron optical sphere that fills the dome with a beautiful, realistic projection of over six million stars, the only one in use in the United States and one of four in the world. A Digistar 3, high-definition system simultaneously projects images and animations of various phenomena in the universe. The combination of these sights with the planetarium's state-of-the-art sound system, provides a dynamic and immersive environment that is nationally recognized and inspires young and old.

The planetarium's director, Kris McCall, is also extraordinary. A visual impairment hasn't stopped McCall from living her dream of sharing the wonder and excitement of the universe and night sky through her inspiring stories and amazing imagery.

In the 15,000 square-foot permanent exhibit wing, "Space Chase," visitors can experience the universe in a new way through hands-on, interactive exhibits. The planetarium's initial show, "STARS," is narrated by Mark Hamill with a soundtrack performed by the Nashville Symphony. Two galleries opened in June 2008 with additional galleries slated for 2009.

## Future Forums Bring Space Exploration to Thousands

As part of the yearlong series of events across the country marking NASA's 50th anniversary, NASA collaborated with the St. Louis Science Center for the March 25, 2008, St. Louis Future Forum. The forum panel—including NASA's Deputy Administrator, astronauts, and the Missouri Lieutenant Governor—engaged nearly 300 business/industry and Government leaders through presentations and open forum discussions on the themes of inspiration, innovation, and discovery of future space exploration.

Thousands of K–12 students and their families experienced space exploration through lunar-related, hands-on activities intermixed with NASA exhibits. Students were further inspired

through autograph-signing and interactive discussions with astronauts, as well as high school student interviews with forum presenters for NASA Career Byte videos. Since success in space begins with today's students, 25 local educators experienced a Field Trip to the Moon session and interactive educational activities to bring back to their classrooms. Field Trip to the Moon is a NASA educational product that combines DVD animation with inquiry-based team-building tasks, made possible by the Exploration Systems Mission Directorate (please see page 36 for more information).

Similarly, on May 14, 2008 nearly 200 technological gurus, space industry and innovation front-runners, educators, and NASA leadership exchanged ideas at the San Jose Future Forum that convened in the heart of Silicon Valley at the Tech Museum of Innovation. Digital participants in Second Life used their "avatars" to ask online moderators questions of the panelists and experienced the Future Forum through movie theater-like screens that played live streaming video and audio. NASA Deputy Administrator Shana Dale announced the launch of NASA eClips, a partnership with the National Institute of Aerospace (NIA) to produce new, short educational video segments for distribution on NASA Television and the Internet.

Thousands of young local students experienced interactive NASA 50th anniversary exhibits at the Tech Museum, which were part of "Space Week at The Tech." Attendees were able to view "Robonaut," a humanoid robot developed through a JSC project that seeks to create a functional robotic astronaut equivalent for extravehicular activities in space. Also on display were models of NASA's future space vehicles, including the new NASA "Constellation" Space Vehicles and a full scale Mars Rover.



# Education Technology and Products Overview



## Leveraging Technology for Engagement

Education technology and products are on the horizon and will enable new learning environments using simulations, visualizations, immersion, online game playing, intelligent tutors, learner networking, e-Professional Development (e-PD), digitized building blocks of content, and more. The goal is to leverage multimedia-rich products and technology infrastructures to deliver exploration-related content to audiences while partnering with NASA's Mission Directorates, professional education organizations, and others to create effective learning experiences and connections for a range of audiences.

## Examples of Education Technology & Products/eEducation Projects and Activities

**NASA Educational Materials Dissemination.** NASA Education products are available in multiple formats to meet the needs of the Agency's educational audiences. Types of products include CD-ROMs, DVDs, videos, educational topics and briefs, educational wallsheets (posters with educational material on the reverse side), educator guides, education program/services brochures, and lithographs.

There are four ways to receive NASA educational materials:

- [www.NASA.gov](http://www.NASA.gov)—the online gateway for information regarding NASA content, programs, and services;
- OfficeMax—partnership provides printing of NASA curriculum support materials;
- Educator Resource Center Network (ERCN)—helps teachers gain local access to NASA's educational resources and training; and
- Central Operation of Resources for Educators (CORE)—through mail order, educators can purchase items such as subject area classroom modules, DVDs, and CD-ROMs, including closed- and descriptive-captioned videos and guides.

**Learning Technologies Project (LTP)** develops and refines leading-edge or cutting-edge technologies that are in use within NASA missions and/or projects to enhance the teaching and learning of scientific concepts. Technologies funded under LTP are incubated and developed, evaluated, and leveraged with strategic partners to extend reach into educational and commercial applications. [Managing Center: GSFC]



**NASA Educational Technologies Services (NETS)** is responsible for publishing and maintaining the educational content on the NASA Web site and managing the operation of the Office of Education Web site, and other electronic-based dissemination networks. Additional Web support is provided in the identification and linkage of multimedia resources to support the education video file (education programming) on the NASA TV Public Services channel and NASA TV Education Services channel. [Managing Center: MSFC]

**\*Learning Environments and Research Network (LEARN)** encompasses three major activities: NASA-sponsored Classroom of the Future, Digital Learning Network (DLN), and electronic professional development infrastructure. The intent of LEARN is to conduct empirical educational research that is the basis for development and testing of off-the-shelf and new educational technologies that incorporate research findings on cognition, effective application of technology to educational settings, integration of NASA content and delivery through videoconferencing, Internet multimedia and handheld devices, and dissemination infrastructures available to the Agency. [Managing Center: LaRC]

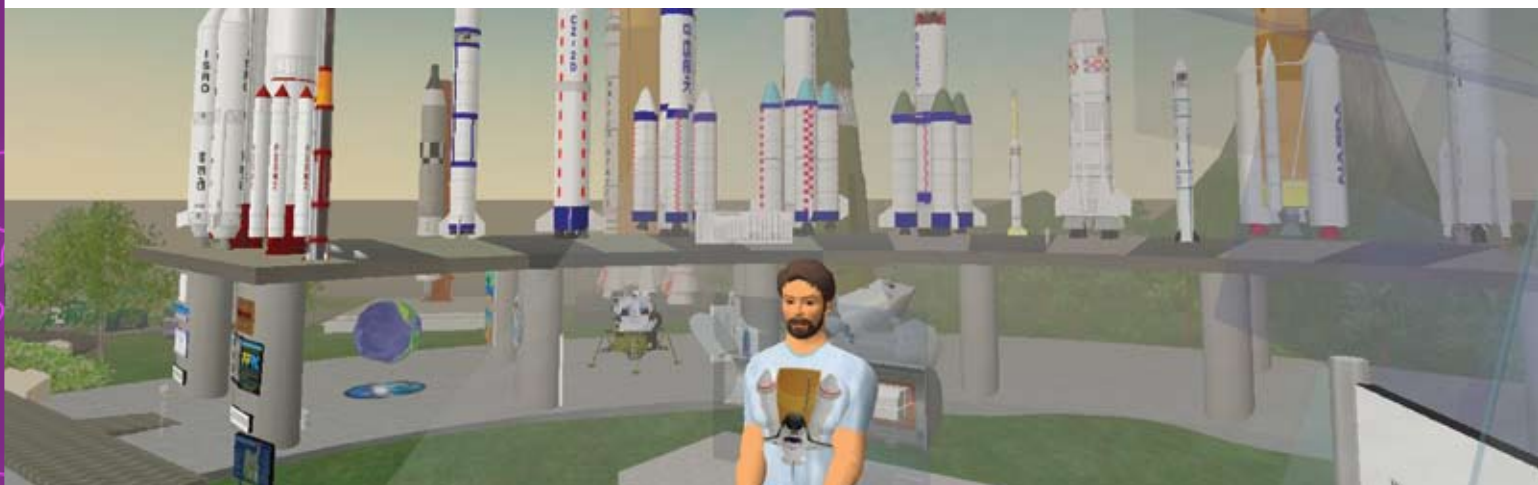
**\*Classroom of the Future (COTF)** conducts empirical educational research, then develops and tests off-the-shelf and new or evolving educational technologies that incorporate research findings on cognition and effective application of technology to educational settings. The educational technologies tested and/or developed use NASA research, datasets, or subject matter experts, and are integrated with curriculum support and teacher enhancement activities. [Managing Center: LaRC]

**e-Education Small Projects** develop infrastructure and deploy research-based technology applications, products, and services to enhance the educational process for formal and informal education. The emphasis is implementation of educational product development, review, and meta-tagging processes and final distribution through approved media, electronic, and/or site-based channels. [Managing Center: MSFC]

e-Education Small Projects include:

**Central Operations for Resources for Educators (CORE)** is a national distribution center for NASA's audiovisual educational materials based at the Lorain County Joint-Vocational School in Ohio.

*\*COTF was incorporated into new LEARN project beginning FY 2009*



## Engaging Students in the Digital Age

NASA aims to continue contributing to the development of the Nation's STEM workforce of the future by identifying and developing the critical skills and capabilities needed to support the U.S. Space Exploration Policy. To do so, NASA must implement effective outreach strategies for engaging its audiences, and the best way to reach today's students is often through digital and electronic environments.

In 2007, a team at NASA MSFC began the process of researching new ways to engage students using technology. The team reviewed multiple styles of podcast, ultimately settling on an interview-style format where a NASA education student participant is interviewed about their experiences supporting NASA missions.

The resulting NASA Student Opportunities podcast series debuted in February 2007 and provides timely information to students on experiences of their peers, while also promoting future educational opportunities. The weekly podcasts are radio-style shows that feature interviews with students who have participated in NASA learning opportunities and allow potential participants to hear first-hand what it's like to be a student member of a NASA team. The free podcast also provides up-to-date information on approaching application deadlines.

Forty-two episodes of NASA Student Opportunities were created from February to December 2007, and as of March 2008 about 650,000 downloads have been collectively logged.

## NASA Explores Virtual Worlds

**Second Life.** "NASA eEducation Roadmap: Research Challenges in the Design of Persistent Immersive Synthetic Environments for Education & Training," was released in 2007, and NASA Learning Technologies (LT) ramped up the exploration of virtual worlds in 2008. The JSC LT team collaborated with the NETS and DLN teams to establish experimental education sites in Second Life, an online, 3-D virtual world entirely created by users, which hosted over 5000 unique visitors in 2008. LT currently works in a leadership capacity with NASA offices, academia, industry, and other Federal agencies to tap the power of immersive synthetic environments.

The JSC LT team facilitated mixed reality events with both internal and external partners which brought participants in a physical location together with those in a virtual space through Second Life. JSC LT was recognized on National Public Radio for facilitating the Science Friday broadcast on the Second Life Teen Grid.

**Innovation in Gaming.** NASA has also received international media attention for releasing a request for information and subsequent request for proposals to develop a ground breaking, NASA-based, massive multiplayer online (MMO) STEM learning game.

Persistent immersive synthetic environments in the form of MMO gaming and social virtual worlds, initially popularized as gaming





and social settings, are now finding growing interest as education and training venues. There is increasing recognition that these synthetic environments can serve as powerful “hands-on” tools for teaching a range of complex subjects. Virtual worlds with scientifically accurate simulations could permit learners to tinker with chemical reactions in living cells, practice operating and repairing expensive equipment, and experience microgravity, making it easier to grasp complex concepts and transfer this understanding quickly to practical problems. MMOs help players develop and exercise a skill set closely matching the thinking, planning, learning, and technical skills increasingly in demand by employers. These skills include strategic thinking, interpretative analysis, problem solving, plan formulation and execution, team-building and cooperation, and adaptation to rapid change.

### A Human Mission to Mars Connects Tennessee and Turkish Students

The NASA Digital Learning Network (DLN) enhances NASA’s capability to deliver unique content by linking students and educators with NASA experts through videoconferencing or Web casting (distributing over the Internet using streaming media technology), at no charge, providing interactive educational experiences to students and educators from kindergarten to university-level across the Nation and around the world.

This was the case in spring 2008 when 5th grade students at Hobgood Elementary, a NASA Explorer School in Murfreesboro, Tennessee and 5th grade students from a school in Turkey connected with NASA for an interactive videoconference about living and working on Mars. Students learned about the challenges involved with sending a human mission to Mars and presented engineering designs they had worked on prior to the videoconference. The videoconference was hosted by an education specialist from NASA’s Aerospace Education Services Project (AESP). AESP specialists share NASA’s use of emerging instructional technologies and the outcomes of NASA’s research, exploration, and discovery with education communities and the public.

### NASA Kids’ Club Goes “To Infinity and Beyond!”

NASA and Disney’s Youth Educational Series have developed a new online program known as the Space Ranger Education Series to coincide with the liftoff of Space Shuttle Discovery to travel to the International Space Station. A 12-inch-tall Buzz Lightyear action figure from the *Toy Story* movies joined the crew of the STS-124 mission in May 2008 as part of a partnership to encourage students to pursue studies in STEM.

The Space Ranger Education Series includes interactive educational games for students, as well as materials for educators to download and integrate into their classroom curriculum. Disney Parks partnered with the NASA Kids’ Club to create five interactive games with educational activities, special audio messages, and “mission blogs” from Buzz Lightyear throughout the mission. The games and activities encourage students to pursue STEM careers so that they, too, can explore “infinity, and beyond!”

### Distance Learning Network America’s Spaceport

As of July 2008, 474 students have benefited from the NASA KSC Digital Learning Network (DLN) America’s Spaceport interactive classroom sessions.

The KSC Education Office launched the pilot for the live DLN Space Shuttle launch Web cast with the KSC DLN Coordinator and Intern as hosts. One hour before the launch of STS-124 in May 2008, viewers tuned in and viewed the famous countdown clock and launch pad in the background as four guest hosts were interviewed and discussed STEM education and careers. They were the deans of engineering from Tennessee State University, Prairie View A&M University in Texas, and Hampton University in Virginia, and the distinguished professor of science and engineering from Florida A&M University. Following this session was a modified version of the DLN America’s Spaceport, a briefing on the crew and mission of STS-124, and viewer questions sent via the DLN Web site and answered live on-air. The program culminated with the exciting launch of Space Shuttle Discovery.

# Aeronautics Research Mission Directorate



NASA's Aeronautics Research Mission Directorate (ARMD) conducts long-term, cutting-edge research in the core aeronautics disciplines across all flight regimes (subsonic, supersonic, and hypersonic flight) that will lead to the development of revolutionary ideas, concepts, approaches, technologies, and capabilities that have broad applicability to the aeronautics community. New investments in undergraduate and graduate education will focus on developing technical excellence in future NASA and aerospace industry researchers and engineers. Over the next several years, ARMD will continue to adjust its education portfolio, consistent with the NASA Education Strategic Framework, to emphasize high payoff efforts in support of the undergraduate and graduate communities. Examples of ARMD educational activities are listed below.

<http://aerospace.nasa.gov>

## Higher Education

ARMD is committed to the development of the future aerospace workforce. A robust workforce of sufficient quality and quantity is required to support the Nation's future aerospace endeavors. As a result, ARMD is focusing its educational efforts on students at the higher education levels in order to encourage an expanded pipeline of talent entering aerospace careers. Curriculum will be developed through partnerships with external groups to fill in subject matter gaps and to expand current programs to meet future aerospace workforce needs. This development will include Web-based, supplemental materials related to undergraduate and continuing educational activities in the aeronautics field, as well as design competitions for university students using capabilities unique to NASA. All of this will be accomplished through collaboration with aerospace professional societies. Scholarships and fellowships are currently being offered by ARMD at the graduate level to support master's degree-level students performing aeronautics-related research and to provide real-world experience at NASA Centers through summer internships. Undergraduate scholarships provide both monetary support for the students and opportunities to perform actual research at NASA Centers during the summer. The NASA Postdoctoral Program will also support a number of postdoctoral students performing research on topics of interest to ARMD.

## Elementary and Secondary Education

While ARMD develops new programs and products for the higher education levels, it also continues to offer an extensive portfolio of electronic and print resources for K–12 educators and students.

## Informal Education

A traveling aerospace design exhibit highlights the design of aerospace vehicles through wind tunnel models and flight hardware.

## ARMD Education Highlights

**NASA Aeronautics Scholarship Program.** NASA's new and expanded Aeronautics Scholarship Program (ASP) is based on a congressional request for support of students pursuing master's degrees in aeronautics-related disciplines. The program is now being offered by the American Society for Engineering Education, which was selected by NASA to manage ASP. In the program's first year of operation, FY 2008, 20 undergraduate and 5 graduate students were selected. ARMD anticipates that a similar number will be annually selected for ASP participation.

Undergraduates receive a two-year scholarship worth nearly \$40,000, including a summer internship at a NASA Center. Graduate students can potentially receive a three-year scholarship valued at nearly \$125,000, including two internships at a NASA Center. ARMD plans to invest approximately \$1.8 million each year on this scholarship program.

**Professional Society Internship/Fellowship Partnership.** In 2008, NASA ARMD partnered with a number of professional societies offering summer internships to qualifying winners of individual society competitions. The American Institute of Aeronautics and Astronautics (AIAA) internship winner was chosen from student papers at regional competitions resulting in a summer internship at NASA Ames Research Center (ARC); the American Helicopter Society International (AHS) internship was awarded to the Lichten Best Paper Award winner who was offered a rotorcraft-based internship; and the American Society of Mechanical Engineers (ASME) internship awards were given to the winners of The Old Guard Oral Presentation Competition.

In particular, AIAA's competition resulted in a graduate aeronautical and astronautics engineer having the opportunity work at ARC to assist in the test and evaluation of thermal-protection material for the Mars Science Laboratory Rover that has been scheduled for launch in 2009.

**Case Studies in Aerospace Research.** ARMD hopes to transfer to students the hard-earned knowledge gained by past aerospace programs by presenting a series of case studies on select topics. NASA has an agreement with the AIAA to publish a subset of the case studies to make them readily available

to aerospace students and practicing engineers. Each study consists of a book and DVD containing additional resources, from videos to reports, to supplement the printed work.

The first two volumes appeared during spring 2008 with the publication of "Road to Mach 10: Lessons Learned from the X-43A Flight Research Program" by Curtis Peebles, a study of the flight testing of the X-43A vehicle. The second, "From Archangel to Senior Crown: Design and Development of the Blackbird" by Peter W. Merlin, is a study of the development of the SR-71 Blackbird aircraft.

In addition to this series, a much larger volume on the development and operation of the X-15 entitled "X-15: Extending the Frontiers of Flight" by Dennis Jenkins was published by the Government Printing Office (GPO) as a NASA Special Publication. This volume was distributed to aerospace engineering departments across the country and offered to their technical libraries. These three volumes are the first of this continuing program to capture and transfer the real-world lessons learned from aerospace programs.

**Smart Skies Excites Students and Teachers About Math and Aviation.** NASA and the Federal Aviation Administration (FAA) continue to expand their efforts to interest middle school students and teachers in math and aviation by using Smart Skies, an online air traffic control simulator for 5th through 9th grade students, in a broad array of student activities and teacher professional development workshops.

Student activities include aviation exhibits/shows, summer camps, career days, and classroom visits. The classroom activities are being greatly expanded through collaboration with the National Air Traffic Controllers Association to bring more controllers into classrooms. To further expand the activities in schools across the Nation, NASA has worked to incorporate Smart Skies into outreach efforts by training education specialists on its use.

NASA is also providing professional development workshops that offer training on Smart Skies to preservice and inservice teachers at venues across the country. These venues include National education conferences, National aviation professional conferences, NASA Explorer School meetings, and presentations over the NASA Distance Learning Network. With its engaging hands-on activities and ties to standards based mathematics, Smart Skies continues to excite and educate students in math-related and aviation careers.



# Exploration Systems Mission Directorate



NASA's Exploration Systems Mission Directorate (ESMD) is developing the next generation of spacecraft, including capabilities and technologies that enable sustained and affordable human and robotic exploration in support of the U.S. Space Exploration policy.

ESMD research also ensures the health and performance of crews during long-duration missions. The ESMD education portfolio supports the broad Agency education goals and is specifically tailored to meet NASA's long-term workforce requirements.

<http://exploration.nasa.gov>

## Higher Education

ESMD Higher Education focuses on increasing the future workforce for ESMD, specifically in the areas of systems, mechanical, electrical, and aerospace engineering, as well as applied physical and life sciences research. Emphasis is placed on providing authentic research and engineering experiences to faculty and undergraduate, graduate, and postdoctoral students. Each year, ESMD supports the Agency-sponsored Graduate Student Researchers Project (GSRP) and the NASA Postdoctoral Program (NPP) by providing funding for additional participants.

Center-managed efforts, such as the Building Bi-Generational ESMD R&D Teams and Spaceward Bound projects, sponsor faculty and/or undergraduate teams to participate in hands-on research in ESMD mission activities. To engage undergraduates further in the engineering fields, ESMD is funding internships within the aerospace industry and is providing funds to encourage the use of ESMD-themed activities for senior design courses.

## Elementary and Secondary Education

ESMD Elementary and Secondary Education reflects the Agency goal of providing STEM-focused educational materials and training to K-12 students and educators. ESMD supports Agency-managed elementary and secondary activities, including the NASA Explorer Schools. Many new K-12 projects are in development and are managed at NASA Centers. Types of investments include educator professional development workshops (e.g., Fundamentals of Lunar Exploration), lesson plans, and guides (such as 21st Century Explorer). Activities represent ESMD themes of robotic and lunar exploration, physical and life sciences, mathematics, engineering and technology development, and health and human performance.

## Informal Education

ESMD Informal Education partners with informal education providers to offer STEM learning opportunities in venues outside the classroom. Through partnerships with museums, science centers, after-school programs, libraries, and community-based

organizations with an emphasis on education, these projects help students find applications and relevance for the STEM concepts learned during the school day.

The theme of lunar exploration is being emphasized in current collaborations with the Girl Scouts of America, the American Museum of Natural History, and other partners.

## ESMD Education Highlights

**Field Trips to the Moon.** The idea of taking a field trip to the Moon would prove exciting to many students and educators. The Field Trip to the Moon DVD makes this dream a reality, with a 3-minute introduction, a 21-minute feature presentation and 7 minutes of extra materials (including “AstroViz: Our Moon” and Moon trivia questions). Field Trip to the Moon combines DVD animation with inquiry-based, hands-on, team-building tasks.

During this adventure, explorers are divided into six highly specialized scientific teams: ecosystem, engineering, geology, habitat, medical, and navigation. Within these teams, educators and students are challenged to select organisms for their food web and ecosystem, chart a path to the lunar landing site with the most accessible natural resources, design a medical kit with the best advantage for treating an emergency, and prioritize payload for Ares V. Teams present their findings after each challenge and negotiate with other teams to achieve optimal “field trip” mission success. The DVD, along with five supplementary toolbox kits, is available on the NASA Education Web site.

**From High School Student to Rocket Scientist.** Managed at JSC, the Space Exploration Advanced Placement (AP) Project is a multi-Center education effort that develops and tests free AP calculus, statistics, chemistry, biology, and physics study materials via partnership with the College Board. Problems are available at the NASA Human Research Program Education and Outreach Web site and the Texas Instruments Education Activity Exchange Web site for use by educators around the world. These problems challenge students to think like NASA engineers as they tackle problems such as calculating the habitable volume of the new Orion crew capsule.

In June of 2008, NASA JSC conducted a collaborative working session between local Clear Creek Independent School District AP math/science teachers and Mission Control Center Front Room flight controllers and instructors. Participants received tours and briefings at JSC, and arrangements were made for the AP teachers to partner with the flight controllers. Together they developed free-response styled application problems using authentic NASA situations and data which ultimately will provide students with the opportunity to temporarily trade their lives as teenagers for those as rocket scientists and engineers.

**Nurturing the Next Generation of Aerospace Systems Engineers for NASA.** The Systems Engineering Educational Discovery (SEED) Project at Johnson Space Center (JSC) includes three major components that enhance aerospace-based systems engineering educational and instructional opportunities nationwide.

The first is a partnership between NASA and the University of Texas at Austin to develop systems engineering curriculum that provides a basic introduction to undergraduate aerospace engineering students. Three students from the spring semester were selected for summer internships at NASA JSC working on systems engineering tasks for the Constellation program.

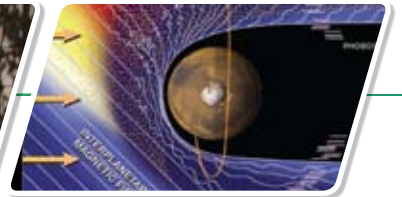
Secondly, students from across the U.S. (nine states) were selected to participate in reduced gravity flights to test NASA-identified systems engineering concepts. Engineers from four Centers participated by mentoring the students who were testing their systems engineering in microgravity.

Finally, in August 2008 a national workshop was conducted to discuss the effectiveness of the pilot systems engineering curriculum and disseminate it within Space Grant consortia universities. Sessions included panels of NASA interns and Systems Engineering experts who shared feedback on the curriculum to over 50 faculty members from universities in 15 states who participated in the workshop.

**Spaceward Bound.** In early April 2008, NASA hosted the Spaceward Bound expedition at the California State University Desert Research Station in Zzyzx, CA. This year’s team trekked into the Mojave Desert and set up camp for a five-day science research expedition aimed at studying how the Mojave is similar to Mars and the Moon and how to search for life in extreme environments.

The expedition offered teachers and students an opportunity to collaborate with scientists, help conduct scientific fieldwork, study the Mojave’s unique geologic formations, and learn more about the supremely adapted microbes that live there.

The project is tied directly to NASA’s goal of engaging Americans in its missions through participatory educational activities. This year’s Mojave program was in partnership with the California State University Chancellor’s Office, San Francisco State University, and the California State University Desert Research Station.



NASA's Science Mission Directorate (SMD) invests in the continued development of a workforce able to pursue Earth and space science research from space, partners with institutions and professional societies in increasing the public's understanding of science and technology, and informs the teaching and learning of STEM subjects in the classroom. Education and Public Outreach (E/PO) is built into all aspects of Science Mission Directorate activities.

<http://nasascience.nasa.gov>

## Higher Education

Higher education provides research support to outstanding students pursuing degrees in all disciplines engaged in Earth and space sciences. Such investments ensure the continued supply of highly trained and qualified individuals to continue the scientific exploration of space. SMD collaborates with the Office of Education on the Graduate Student Researchers Project (GSRP) and Undergraduate Student Research Project (USRP) and enhances them with additional support such as the NASA Earth and Space Science Fellowship. SMD also focuses on strengthening the instructional capacity at colleges and universities that are not routinely exposed to new scientific

research, including improvement of academic projects in Earth and space science, and providing mentoring and undergraduate research for underrepresented groups of students, etc.

## Elementary and Secondary Education

These activities aim to improve formal education by:

- the use of SMD missions/programs to support local, state, regional, and national STEM education change efforts through collaboration with internal and external stakeholders
- the use of SMD missions, facilities, human resources, and programs to provide exposure and experiences to teachers and faculty to support the enhancement of knowledge and skills and to provide access to NASA information in science and mathematics
- the development, utilization, and dissemination of science, mathematics, geography, and technology instructional materials based on SMD missions and results
- the use of SMD missions, facilities, human resources, and programs to provide information, experiences, and research opportunities for students in order to support the enhancement of knowledge and skills in the STEM areas

## Informal Education

Informal education and public outreach activities inspire and engage learners of all ages through partnerships with community-based groups, including museums and planetariums, Girl



Scouts, and amateur astronomers/citizen scientists. Examples are planetarium shows developed or produced with direct SMD mission/program involvement, exhibits developed with direct SMD mission/program involvement and installed in a science center or museum, and materials or content supplied by SMD missions/programs for use as components of planetarium shows or museum exhibits.

## Early-Career Programs

These activities provide competitive research support to recent science and engineering Ph.D. graduates who are pursuing academic and/or research careers in Earth system science, heliophysics, planetary studies, or astrophysics. Examples include the New Investigator Program in Earth science, the Early Career Fellowship Program in planetary science, and the Chandra and Hubble Fellow programs in astrophysics.

## SMD Highlights

**DEVELOP Team and NASA SSC Use Earth Science to Aid Gulf Coast.** The Stennis Space Center (SSC) DEVELOP team looks to bridge NASA remote sensing technology with local policy and decision makers along the Gulf Coast. Utilizing SSC's unique position in coastal Mississippi, the team has conducted an in-depth examination of NASA's Ice, Cloud, and Land Elevation Satellite (ICESat) capabilities in post-hurricane forest damage detection. They have also examined the Earth-observing satellite, Landsat, and the Moderate Resolution Imaging Spectrometer's (MODIS) carbon estimation capabilities along the Gulf Coast.

Unveiled in 1998, DEVELOP is a student-led, student-run project that provides a framework for initiating activities to help communities. Under the guidance of science advisers from NASA and its contracting organizations, high-school and college students demonstrate to community leaders prototype applications that could help them solve local problems using the Agency's rich store of remote sensing data.

In 2008, the Stennis DEVELOP team met with NASA officials such as the NASA Science Mission Directorate Associate Administrator and the NASA Applied Sciences Associate Director. They also presented at national scientific forums.

### **"Touch the Invisible Sky" Unveils the Unseen Universe**

A new NASA publication is introducing readers of all visual abilities to the concept of the electromagnetic spectrum. Using Braille, large print, and tactile images from the Hubble Space Telescope, Spitzer Space Telescope, Chandra X-ray Observatory, and ground-based telescopes, the book explores how various observatories complement the findings of one another. "Touch the Invisible Sky" debuted at a ceremony at the National Federation of the Blind on January 15, 2008 and is available through the National Federation of the Blind, Library of Congress repositories, and a wide-range of public institutions.

This innovative book was created with support from a Chandra education grant and collaboration between Spitzer, Chandra, and Hubble Space Telescope observatories and the NASA Education Forums at the Harvard-Smithsonian Astrophysical Observatory and Space Telescope Science Institute.

### **Sun-Earth Day 2008: Space Weather Around the World.**

NASA Sun-Earth Day engages millions of participants with heliophysics throughout the year through live Web casts, NASA TV programming, museum programs, amateur astronomy events, and classroom activities culminating with a celebration on or near the Spring Equinox. Heliophysics is the study of the Sun-solar system connection.

Classroom-based Space Weather Action Centers (SWAC) and podcasts have raised public awareness of education technology as well as heliophysics data. In 2008 middle schools teachers and students were invited to participate in Solar Week in Spring 2008 to learn about solar science, solar energy, and careers.

**ESSEA: Teaching Teachers of Earth Science.** The Earth System Science Education Alliance (ESSEA) is training K-12 educators in the systems approach to Earth science so they can provide future scientists with the broad perspective necessary to better understand Earth and tackle complex environmental problems.

Through ESSEA, teachers earn undergraduate or graduate credit while learning to teach Earth system science using inquiry-based classroom methods. The courses are offered online through a network of educational institutions across the country. More than 40 institutions are engaged in ESSEA by offering courses, providing resources to the network, and helping to develop new modules for the courses. As of June 2008, over 2,500 teachers across the U.S. have completed ESSEA courses.

**The Exploring the Solar System Toolkit** gives amateur astronomers current NASA mission science, hands-on activities, and mission information to be used in public presentations and star parties. So far, the kit has been used by over 27,000 individuals associated with the NASA Night Sky Network and will provide major support to events focusing on 2009, the International Year of Astronomy, the United Nations-sponsored celebration of the 500th anniversary of Galileo using his telescope to study objects in the sky.

The toolkit is a product of collaboration between NASA's Solar System Exploration Forum and the Astronomical Society of the Pacific.

# Space Operations Mission Directorate



NASA's Space Operations Mission Directorate (SOMD) seeks to provide educational projects, products, and activities to inspire the next generation of explorers to take the next steps in the U.S. Space Exploration Policy. Additionally, SOMD strives to support educators who prepare students to meet national elementary and secondary education standards in STEM. The Mission Directorate engages learners in hands-on experiences related to space operations. Below are examples of SOMD educational activities.

<http://spaceoperations.nasa.gov>

## Higher Education

Reduced-Gravity Student Flight Opportunities encourage undergraduate students to propose, design, fabricate, fly, and evaluate a reduced-gravity experiment over six months.

The Great Moonbuggy Race challenges undergraduate and high school students to compete in teams, applying engineering skills to design a collapsible vehicle powered by one male and one female and ride it through a simulated lunar terrain obstacle course.

Preservice Teacher Institutes train preservice teachers on how to use NASA educational materials with hands-on science pedagogy.

NASA Means Business challenges science, communications, and fine arts students to produce NASA public service announcements and conduct educational outreach with their product.

The NASA Postdoctoral Program allows postdoctoral students to conduct research for the SOMD at participating NASA Centers.

## Elementary and Secondary Education

The NASA Educational Exploration Team (NEET) Educator Resource Center provides educational materials and multimedia resources for all visiting classes and educators from around the country at KSC. The NEET Exploration Station provides training for visiting educators and classes at KSC's unique facilities.

The Digital Learning Network provides K-16 educators and students, along with science museum audiences, with a chance to talk to scientists and see NASA-unique facilities via two-way video and Web cast.

The Kennedy Launch Academy Simulation System (KLASS) offers software that converts a computer lab into a launch simulation room. Teachers can select scenarios for various science content areas and grade levels.

The Student Launch Initiative challenges high school students with a competition to design, build, and test reusable rockets with scientific payloads.

## Informal Education

NASA Brain Bites produces Emmy award-winning broadcast TV products, 30 and 60 seconds in length, that share high interest

concepts and answer frequently asked questions. They are used for classrooms, museums, exhibits, broadcast TV, and NASA TV and radio.

Astro Camp provides a variety of one-day to one-week camp experiences that are tailored to middle school students. These camps are held at SSC, schools, exhibits, and other venues that use exciting, hands-on activities to help students learn about propulsion.

## Minority Outreach

Diversity Education Grants offer grant awards to three higher education institutions to serve underrepresented and underserved K–12 educators and students and help them pursue STEM careers.

Minorities in Science and Engineering serves as a work-study program for scholars and provides faculty mentoring, peer tutoring, and ongoing research for African-American high school students to encourage college enrollment in science and engineering.

Exploration Infusion delivers NASA content, training, workshops, coaching, and activities to the Gulf Coast Education Initiative Consortium and the Mississippi Band of Choctaw Indians; it serves 21 districts, 252 schools, and 128,000 students and teachers.

## SOMD Education Highlights

**NASA Astro Camp Introduces Children to Space Exploration.** NASA SSC's Astro Camp summer 2008 theme was "Soar to Explore: NASA Turns 50," and campers studied propulsion, NASA history, and future missions. Astro Camp introduces thousands of children to space science through week-long summer camps, Saturday camps, and traveling events.

2008 Astro Camp students learned about the principles of propulsion and NASA's Constellation program through exciting hands-on activities including rocket launches, egg drops, ISS model construction, and biosphere and spacesuit design. This year, the Astro Camp project partnered with Mississippi State University Bagley College of Engineering to bring their "Summer Engineering Experience" (SEE) program to SSC for students aged 13–15. Teenage campers studied robotics, mathematics, and the principles of motion in catapults and roller coasters. In addition, the Astro SEE students had the opportunity to build and launch solid rockets.

All of these activities serve to inspire and engage students and help foster an interest in NASA and science and technology.

**MI FUTURO (My Future) Holds 6th Annual NASA Hispanic Youth Conference.** Project Mi Futuro, is a NASA-sponsored project designed to inspire Hispanic high school students to stay in school, graduate, and pursue STEM majors in college. The project sponsors an annual conference hosted by NASA MSFC that is attended by over 150 Hispanic students and their

educators. The 2007 conference featured a presentation on the NASA Great Moonbuggy Race and other NASA engineering design challenges and sessions—presented by former Mi Futuro students currently enrolled in college—on skills required to achieve success in college. Project Mi Futuro offers school-based, after-school STEM enhancement and career awareness, and a week-long residential summer Mathematics and Science Academy.

**NASA's Student Launch Initiative (SLI).** Top-performing Team America Rocketry Challenge and Rockets for Schools teams are eligible to participate in the NASA SLI, an advanced high-powered rocket and payload project. NASA's SLI involves middle and high school students in an 8-month project to design, build, and test a reusable rocket that will reach 1 mile above ground level with an associated scientific payload. In addition to actual vehicle and payload performance, teams are also evaluated on design and other criteria through reports, presentations, and safety checks.

The initiative is more than designing and building a rocket from a commercial kit: it involves diverse aspects such as scheduling, purchasing, performing complex calculations, financial planning, logistical coordination, media relations, and documenting impact made on education through reports and design reviews. Teaming with engineers from Government, industry, and academia, students get a hands-on, inside look at science and engineering careers. The NASA SLI educational experience culminates in the spring with a tour, technical presentations, and launch at MSFC.

**Kennedy Launch Academy Simulation System (KLASS) Counts Down!** KLASS is a launch countdown software package that simulates a firing room for students in any group of networked computers. The students serve as the engineers to solve issues and problems, and launch the Shuttle successfully. During prototype testing at Fort Caroline Middle School in Jacksonville, FL, students were excited to learn science and math. Because of the impact on student interest and achievement, the school has developed a virtual science lab for all students to participate in the KLASS simulation. Students will use KLASS and the KLASS curriculum to enhance to their current content in Science Process skills, Earth Science, Life Science and Physical Science. One teacher stated, "KLASS has made these students hungry to learn more about NASA's mission for human space exploration." Funded by SOMD, a current contract is expanding educational materials and making implementation easier for all schools. The software and newly expanded educational content was publicly released in 2008.



# Ames Research Center



NASA Ames Research Center (ARC) specializes in research geared towards creating new knowledge and new technologies that span the spectrum of NASA interests. ARC education serves Alaska, Northern California (southern-most counties of Inyo, Kings, Monterey, and Tulare), Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

<http://www.nasa.gov/centers/ames>

## Higher Education

**International Space University Summer Session 2009** is an intensive nine-week course of study for postgraduate subjects ranging from engineering and physical sciences to satellite applications and policy. An international cadre of distinguished professors will teach the classes, and students will benefit from the mentorship of NASA scientists, engineers, and researchers, and the Agency's academic and industry partners, including Google and Lockheed Martin.

**Education Associates Project**, administered through the Space Grant Foundation, offers college and university students and faculty the opportunity to participate in a hands-on experience at a NASA Center working with NASA scientists, engineers, and managers on a NASA project. The projects will run the gamut of NASA's missions—from the Space Shuttle to

exploring the solar system, exploring extreme environments on Earth, and research aircraft.

**Science Teacher and Researcher (STAR) Project** provides science majors who are planning to be 6th-12th grade science teachers the opportunity to engage in paid laboratory research internships. ARC implements this project in partnership with the California State University (CSU) system.

**Foothill-DeAnza Internship** provides opportunities for students in Foothill-De Anza Community College District to participate in onsite internships. For more than 35 years, this program has been serving students as well as sponsors of internships, including NASA ARC. Internships are offered in multimedia/Web, computer science, communication, business, engineering, and science.

**NASA Exploration Academy** identifies potential future NASA leaders and brings them to NASA ARC for an intensive ten week overview of all aspects of NASA missions. Potential future NASA engineers learn firsthand about the challenges of space transportation in the new millennium.

**NASA Robotics Academy** is a NASA multi-Center, 10-week residential internship during the summer for undergraduate students specifically interested in robotics. Participants are assigned to a team project developed by NASA, local industry or an academic institution. This project is funded by SOMD.

**Systems Teaching Institute (STI)**, provided through University of California Santa Cruz and NASA ARC, offers a 10-12 week summer research experience for graduate students in fields relevant to ARC research. Students work closely with ARC scientists and engineers, and attend seminars, career development workshops, and an end-of-summer symposium.

## Elementary and Secondary Education

**Launch into Technology**, offered in collaboration with the Girl Scouts of the San Francisco Bay Area, hosts high school-aged Girl Scouts for two, seven-day residential institutes, focused on robotics and aeronautics.

## Ames Research Center Education Highlights

**Ames Exploration Encounter (AEE)**. The Ames Exploration Encounter (AEE) is a Center-unique project that provides students in grades four through six a half-day, hands-on educational experience. Over the last 17 years, the AEE has hosted more than 100,000 students. Set in a retired wind tunnel, the students are introduced to the basic science and mathematics concepts that form the basis of NASA research and map to California Science Standards. In 2008, a third-party evaluation of the facility was conducted, and the results indicated that the project had strong positive results on the students, and was highly regarded by teachers. The project inspires students to learn more about STEM and intrigues them about the possibility of working for NASA.

**University Affiliated Research Center (UARC)– Systems Teaching Institute** creates student activities and resources that offer practical training to students pursuing careers in STEM fields of relevance to the NASA mission. The Institute hosts an annual Graduate Student Internship, now in its third year, that supports approximately 10-15 students each summer. In 2007, the UARC piloted a new student activity: the Small Spacecraft Summer Study Project, or S4P. The UARC solicited proposals from University of California scientists to develop a low-cost scientific mission in collaboration with the NASA Ames Small Spacecraft Center—a mission that is relevant to the NASA strategic plan. A national recruitment yielded six talented graduate students, each with a unique expertise, who came together for an intensive concept design study led by NASA scientists and engineers. This year, 12 students and 7 scientists are working at ARC to develop the design for a mission to a potentially Earth-crossing asteroid.

**Science Teacher and Researcher (STAR) Project at ARC Launched** and is a partnership of CSU with Department of Energy (DOE) national research laboratories (Lawrence Livermore National Laboratory and Lawrence Berkeley National Laboratory) and NASA ARC. The purpose of STAR is to provide science majors who are planning to be 6-12th grade science teachers the opportunity to engage in paid laboratory research internships.

The 11 STAR participants in the 2008 summer pilot at ARC conducted research projects alongside NASA scientists and attended weekly enrichment workshops. Using NASA resources, the workshops are designed to focus on and enhance the students' knowledge of science education and foster inquiry-based science teaching and learning strategies to increase science interest and learning among K-12 students. On July 26, 2008 a science education and career planning conference was held at ARC for all 30 students from the 5 local STAR laboratory sites. The event featured STAR mentors, university faculty, Federal laboratory and project staff, master teachers, CSU deans, and local K-12 panelists and speakers.

ARC is currently pursuing a Space Act Agreement with the CSU system to extend the partnership beyond STAR to include other preservice and inservice professional development activities.

# Dryden Flight Research Center



As the lead for flight research, NASA Dryden Flight Research Center continues to innovate in aeronautics and space technology. The newest, the fastest, the highest—all have made their debut in the vast desert skies over DFRC. DFRC education serves Arizona and Southern California (northern-most counties of Kern, San Bernardino, and San Luis Obispo).

<http://www.nasa.gov/centers/dryden>

DFRC is currently partnering with the Aerospace, Education, Research, Operations (AERO) Institute, a Palmdale, CA-based nonprofit organization, via a cooperative agreement for the purpose of supporting education and outreach activities aligned with NASA's education goals and DFRC's mission. The AERO Institute is a consortium of Federal, State, and local Governments, industry, and academic partners with the common goal of enhancing the current STEM research, along with educational and operations programs needed to enable and maintain the viability of the aerospace workforce.

The general categories within the cooperative agreement are:

- a. Partnerships and collaborations with industry, academia, and other Federal and State organization in support of technical workforce development.
- b. Facilities and Equipment: Colocation of staff and sharing of educational materials and equipment.
- c. Education Programs: Design, coordination and implementation of various education elements:

## Higher Education

**AERO Higher Education/MUREP Activities** support the implementation of DFRC's Higher Education Student and Faculty projects, including scholarship and internship projects and activities for high school, undergraduate, and graduate students who receive mentorship by professionals within NASA, industry, and academic partners.



## Elementary and Secondary Education

**AERO Pre-college Program Activities** include development of educational materials and educational project plans of the SOFIA aircraft and the DC-8 Airborne Laboratory project aircraft. Expedition Two Base Camp is an activity for middle school students held in July 2008.

## Informal Education

**AERO Informal Education Activities.** NASA is commemorating congressional enactment of the National Aeronautics and Space of 1958 by incorporating a 50th anniversary theme in informal education activities during FY 2008. The AERO Institute cooperatively demonstrated and distributed educational activities/products to the informal education community.

## Dryden Flight Research Center Education Highlights

**Bringing the Moon Closer to Classrooms.** As NASA prepares to embark on return missions to the Moon with the Constellation Program, over 220 educators have received procedural certification in handling and storing NASA's lunar samples. Targeting underserved areas of Arizona, the Arizona Moon Project's goal is to provide activities and resources to promote students' science process skills, and complement science and mathematics educational standards while applying lunar themes.

In addition to educator workshops, multiple student assemblies were presented to inspire and inform approximately 600 students. Both the workshops and assemblies included an overview of Constellation including the Crew Exploration Vehicle. Students and teachers learned about the historic Apollo missions while viewing lunar samples under microscopes. They also worked on several in-class activities from the "Exploring the Moon" educator guide, to creating their own mission patch for a "future" Moon mission.

This project enabled teachers and students in Arizona to have the opportunity to work with real lunar samples, while understanding the importance of NASA's upcoming missions to the Moon.

**Arizona Educator Resource Center's Teacher Academy in Aerospace Education.** Arizona's Educator Resource Center is located on Embry-Riddle Aeronautical University's Prescott campus and is instrumental in bringing NASA education resources to teachers and students in Arizona through monthly workshops for educators, an annual Middle School Math &

Science Olympics, educational programs for students—and most recently—a week-long Teacher Academy in Aerospace Education for teachers.

Arizona mathematics, science, and technology teachers participated in the Teacher Academy during June 23-27, 2008. Goals included: building educators' content knowledge and skill base in aerospace science and equipping teachers with engaging and advanced STEM teaching methods thereby increasing teachers' ability to positively influence students' interest in and understanding of aerospace science. The Academy included a mini-course in aerospace education; a campus-unique experience utilizing physics labs, and utilization of NASA educational materials.

# Glenn Research Center



NASA Glenn Research Center (GRC) develops and transfers critical technologies that address national priorities through research, technology development, and systems development for safe, reliable aeronautics, aerospace, and space applications. GRC education serves Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

<http://www.nasa.gov/centers/glenn>

## Higher Education

**Lewis' Educational and Research Collaborative Internship/Fellowship Project (LERCIP)** provides internships for students of science, engineering, professional administrative, and technical areas. Internships of ten-week duration are available during the summer months at NASA GRC. The project is a collaborative undertaking by the GRC Educational Programs Office and the Ohio Aerospace Institute (OAI).

## Elementary and Secondary Education

**Exploring** is a worksite-based project for young men and women who have completed 8th grade and are aged 14 to 20. GRC collaborates with the Boy Scouts of America to provide the project which has five areas of emphasis: career opportunities, life skills, service learning, character education, and leadership experience. Activity groups led by GRC volunteers who serve as Exploring Advisors meet one weekday evening a week from

October through April to work on group projects in aeronautics, computer technology, and human space flight.

**Lewis' Educational and Research Collaborative Internship Project (LERCIP) for High School** provides a summer opportunity to permanent residents of Northeast Ohio who will be juniors and seniors in the upcoming school year and are interested in STEM and professional administration. Internships of eight-week duration will be available mid-June through early August.

**New Approach to Self Achievement (N.A.S.A.) Project** is a six-week summer program for students attending Cleveland Metropolitan and Lorain County Schools who will be 7th or 8th graders in the fall. The program is designed to capture students' interest in science and mathematics. Located in an urban setting, the N.A.S.A. Project seeks to target students who have a cumulative GPA between 2.0 and 3.0, demonstrating a deficiency in the areas of mathematics and science, and requiring a gentle push to reach their academic and life potential. The program is also designed to help prepare students for the Ohio Achievement Test by providing a weekly Scholastic Challenge Contest.

**Shadowing** provides high school students with a career exploration experience for one day or up to one week on-site at GRC. Opportunities are available during the school year for students interested in STEM areas and professional administration.

**Tennessee State University College Bound (CB)** is an intensive two-week summer academic workshop designed

to introduce minority and female students to the profession of environmental engineering. CB participants will examine environmental issues from engineering, social, and political perspectives. CB is held in the College of Engineering, Technology, and Computer Science on the campus of Tennessee State University in Nashville, TN.

## Glenn Research Center Education Highlights

**Astronaut Shares Space Tales with Students.** The Lewis Educational Research Collaborative Internship Program (LERCIP) is a collaboration between the GRC Educational Programs Office and the Ohio Aerospace Institute and is hosting 39 participants representing 27 local high schools in Northeast Ohio.

In 2008, students were presented with a rare opportunity during their orientation when NASA astronaut and STS-123 crew member Michael Foreman, an Ohio native, visited with them. Foreman shared information about his 16 days in space aboard the Space Shuttle Endeavor where the crew delivered the first module of the Japanese laboratory, Kibo, and the final piece of the station's mobile servicing system to the space station.

LERCIP has also been shown to lead to employment at GRC, and contributes to NASA's goal to educate and eventually employ students in STEM careers. In 2007, 9 out of the 18 cooperative education participants hired at GRC were participants in the LERCIP. In 2008, 48 out of 115 LERCIP students were past participants of other GRC student programs (i.e. Exploring, LERCIP High School, Shadowing, etc.)

**Exploring Receives Highest Recognition from Boy Scouts of America.** The NASA GRC Exploring project received the 2008 William H. Spurgeon, III award from the Boy Scouts of America, which is the highest recognition for individuals and organizations contributing significant leadership to the Exploring Program. Exploring is a worksite-based program of Learning for Life, a subsidiary of the Boy Scouts of America, for young men and women who are 14 through 20 years old.

The success of the GRC Exploring project can be attributed to the volunteers who work with its Educational Programs Office, engineers, scientists, and technologists. Participants were engaged in the basic principals of aerospace, vehicle, and propulsion systems, and built rockets infusing aerodynamic/structural design and fabrication, and worked on power system modules. In the realm of computer technology, participants designed Web pages, worked on product development, and processed acoustics.

Participants also created space growth chambers and participated in the Engineering Design Challenge. They designed a lunar plant growth chamber similar to the one used

on the STS-118 mission, which could sustain plants on the surface of the Moon. The student chambers were constructed and designed using household items in relation to the various atmospheric challenges the Shuttle would experience.

**NASA Education Project Provides Students and Families with a New Approach to Self-Achievement.** Activities for students include classroom instruction and projects that provide hands-on experience in applying science and mathematic concepts, innovative proficiency for test-taking strategies, computer education classes, and a variety of enrichment activities such as future career counseling and field trips. Unique to this project are the Saturday Family Workshops, which are designed to engage students and their families in the NASA culture and inform them about factors that influence educational development. These family workshops equip students with tactics to become advocates supporting STEM education in their communities and to continue on to become part of NASA's workforce in the future.



# Goddard Space Flight Center



The mission of NASA Goddard Space Flight Center (GSFC) is to expand knowledge on Earth, its environment the solar system, and the universe through observations from space. GSFC education serves Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

<http://www.nasa.gov/centers/goddard>

## Higher Education

**NASA Academy** is an intensive, residential, 10-week summer experience at the university level with laboratory research work, a group project, lectures, meetings with experts and administrators, visits to NASA Centers and space-related industries, technical writing, and presentations.

**Robotics Academy** is a 10-week residential internship during the summer for undergraduate students specifically interested in robotics. Participants are assigned to a team project developed by NASA, local industry, or an academic institution.

**NASA Summer Aerospace Workforce Development Research Intern Program (SAWDRIP)** is a collaboration among: GSFC Higher Education Office, Maryland Space Business Roundtable (MSBR), and Maryland Space Grant

Consortium. Students are placed in state-of-the-art projects with aerospace companies providing experience in skills marketable to NASA and aerospace partners.

**NASA/Johns Hopkins Applied Physics Laboratory Student Intern Project** is a 10-week research experience at Applied Physics Laboratory (APL), a research and development division of The Johns Hopkins University that supports the Department of Defense (DOD), NASA, and other Government agencies through innovative applied research, technical development, and problem solving.

**NASA/Independent Verification & Validation (IV&V) Internship** consists of a 10-week resident summer research activity for diverse undergraduate and graduate students interested in careers in computer science, software engineering, information systems, or related fields.

**Student Internship Project (SIP)** is designed for students whose primary interest is space-related research. SIP is an intensive 10-week summer research activity for diverse undergraduate and graduate students interested in careers in aerospace fields.

**Summer Institute in Engineering and Computer Applications (SIECA)** broadens participants' professional perspectives through exposure to a variety of research/application environments through a 10-week "hands-on" work experience in various space-related scientific and technological fields.

**Summer Institute on Atmospheric, Biospheric, and Hydrospheric Sciences** is a 10-week student research project which consists of lectures by prospective mentors describing their proposed research followed by 9 weeks of research on projects the students have selected with results presented in a concluding symposium.

**Science Technology, Engineering Pipeline for Underserved Populations (STEP—UP)** is an eight-week internship at Wallops Flight Facility or Maryland Institute for Space Technology.

**Graduate Student Summer Program (GSSP)** in Earth Science provides students with the opportunity to conduct intensive research in one of GSFC's Earth Science laboratories.

**New York City Research Initiative** is made up of 12 research teams composed of a high school student, a high school teacher, and an undergraduate student assigned to an existing group of researchers led by the principal investigator. Seven teams are located at various universities in the NYC Metropolitan area, and five teams are working at the Goddard Institute for Space Studies.

## Elementary and Secondary Education

**High School High Tech** is an ongoing endeavor to encourage high school students with disabilities, particularly minorities, to prepare themselves and pursue STEM degrees in college, then technical careers. Activities include site visits, six-week summer employment opportunities, meetings with mentors who are technical professionals with disabilities, and workshops on technical fields of study and college preparation.

**High School Intern Project** engages rising high school juniors in real-time STEM applications in a research-focused work world. Interns learn more about space exploration and GSFC-specific areas of Earth science, space science, engineering, and technology.

**NASA/Morgan State Summer Institute of Robotics** is a 4-week session designed to provide 25-30 students the opportunity to learn and discover the science and technology of robot design and operation.

**Summer Institute in Science, Technology, Engineering and Research (SISTER)** is a five-day experience giving middle school girls the opportunity to explore career fields with research scientists, mathematicians, and engineers.

**History of Winter (HOW)** is a winter camp in Lake Placid, NY that instructs science teachers about snow and ice.

## Goddard Space Flight Center Education Highlights

**Collaboration with Bureau of Indian Education.** In 2008, a Space Act Agreement was signed between Goddard Space Flight Center (GSFC) and the Bureau of Indian Education (BIE). The purpose of this agreement is to enable a collaborative partnership between NASA GSFC and BIE that advances the educational needs of American Indian and Alaskan Natives (AI/AN) in science and technology. Pursuant to NASA's Education Framework, this agreement contributes to NASA's goals of attracting and retaining students in STEM disciplines, and strengthening NASA and the Nation's future workforce. Through focused educational support that promotes learning among targeted populations, the education activities and opportunities will enable AI/AN students to move through a focused progression of engagement and education aimed toward fostering employment within a wide-range of NASA-related STEM disciplines. This collaboration is designed to: 1) promote science and technology literacy among AI/AN communities, 2) develop a common/shared understanding of the most effective practices for engaging AI/ANs in STEM careers, and 3) build on BIE strengths and competencies that support these goals. This partnership extends and strengthens efforts in promoting science and technology literacy and encouraging AI/AN peoples to excel in science and technology careers.

**NASA's First Nobel Laureate Addresses GSFC Higher Education Students.** GSFC Higher Education summer intern projects have over 175 participants for summer 2008. Interns participated in the NASA Academy, Summer Intern Program (SIP), Robotics Academy, Summer Institute in Engineering and Computer Applications Program (SIECA), American Indian Science and Engineering Society Intern Program (AISES), ACCESS, MUST, USRP, and other programs.

Dr. John Mather, NASA's first Nobel Laureate, addressed these students during the second week of the summer session, gave the keynote address during the symposium, and posed for photos with some of the interns.

NASA's MUREP Symposium was cosponsored by GSFC and the United Negro College Fund Special Programs Office, July 21–25, 2008. The symposium included the Jenkins Predoctoral Fellowship Program, NASA Administrator's Fellowship Program, Curriculum Improvement Partnership Award Project, and the Motivating Undergraduates in Science and Technology participants.



# Jet Propulsion Laboratory



NASA Jet Propulsion Laboratory (JPL), managed by the California Institute of Technology (CalTech) is NASA's lead Center for robotic exploration of the Solar System. JPL education serves California.

<http://www.nasa.gov/centers/jpl>

## Higher Education

**Space Technologies Education Project (STEP)** develops the technical talent necessary for NASA's and JPL's workforce. STEP is modeled after successful programs such as the previous STEP—Skilled Trades Employment Program—that ended in 1992, enjoyed support from a period of more ample resources, and provided JPL with quality technicians.

**Student Independent Research Internship (SIRI)** is a one-semester internship at JPL for students enrolled in an independent study course at a participating college.

**JPL Summer Faculty Research Project** is a series of collaborations between NASA Research and Development Centers and nearby universities that allow engineering and science faculty members to spend 10 weeks working with professional peers on research.

**JPL Undergraduate Scholars Project (JPLUS)** was developed to recognize achievement and high potential in students attending the 30 community colleges closest to JPL and Pasadena. Scholarships and an opportunity to apply for

a research fellowship under SURF are available through this project. Faculty representatives at the colleges nominate students each year.

**Alliance for Learning and Vision for Underrepresented Americans (ALVA)** is a partnership between JPL and the University of Washington College of Engineering. Freshmen are assigned high-tech responsibilities that improve their college financing and give them a taste of a professional career. The 10-week experience consists of 30 hours of high-technology work assignments augmented with 10 hours of workshops to promote proficiency in mathematics.

**JPL Research Apprenticeship (RA) Project** allows experienced and qualified students to participate in research activities at JPL. Because JPL missions involve major engineering design and fabrication efforts and produce a huge amount of scientific data, a pool of high-quality student research apprentices can help in the engineering and scientific work on these projects.

**Summer Undergraduate Research Fellowship (SURF)** is a project based at Caltech and introduces undergraduate students to research at the Caltech campus or at JPL under the guidance of seasoned mentors. Students experience the process of research as a creative intellectual activity and gain a more realistic view of the opportunities and demands of a professional research career.



## Jet Propulsion Laboratory Education Highlights

**NASA Museum Alliances Celebrate Mars Landing.** When the Mars Phoenix spacecraft arrived at the red planet on May 25, 2008, NASA's Museum Alliance members were poised to share the excitement of the landing in real time with their own members. Earlier that spring, JPL hosted a number of teleconferences with mission scientists and technical personnel to familiarize the Museum Alliance members with the mission's objectives and timeline so that they could host educational programs in their communities. The members also received presentation materials and DVDs for the events. A live Mars landing visually generates a great deal of excitement and Phoenix landing on the polar region of Mars was no exception. Museum Alliance partners in Alabama, Arizona, Colorado, Illinois, Kentucky, Oregon, and many other parts of the country reported large crowds. The goal of the Museum Alliance is to assure that museums, science centers, planetariums, and other informal education organizations have ready access to news, image products, schedules, and professional development for NASA missions. Over 300 U.S. museums and 35 non-U.S. museums are represented in NASA's Museum Alliance.

**NASA Explorer Schools Engage in Robotics.** Robotics education is a JPL strength area, and the facility frequently provides teacher training based on NASA's current and future robotics missions which in turn lead to student projects connected to exploration. JPL conducts the Southern California NASA Explorer Schools Robotics Competition (SoCaNESRoC) for NASA Explorer Schools located in Southern California. The competition and engineer/scientist presentation is disseminated through NASA's Digital Learning Network. Teams of four students program their robots to accomplish a series of tasks on a simulated planetary surface within a fixed time. Simulated tasks include retrieving mineral formations, clearing rocks for a base, positioning a habitation module, and retrieving a stranded rover.

In 2008, 84 students on 21 teams traveled to JPL for a competition that featured elementary, middle, and high schools competing in two divisions. Students also had a chance to interact with JPL scientists and engineers about robotics and career pathways. The purpose of SoCaNESRoC is to give students the opportunity to employ inquiry-based problem-solving skills while working toward a goal in teams, much like JPL scientists and engineers. This competition encourages the schools to make technology education a regular part of their school year and the Webcast serves as a model of a successful and intense competition.

**Cassini Scientist for a Day.** With its stunning rings and dozens of moons, Saturn is an intriguing planet. The Cassini spacecraft is the first to explore the Saturn system of rings and moons from orbit. Cassini entered orbit on June 30, 2004 and immediately began sending back images and data.

In 2008, Cassini gave 5th-12th grade students across the U.S. and the world the opportunity to study Saturn and make authentic scientific decisions similar to the mission's scientists. Cassini's cameras were programmed to take images of three designated targets on June 10, 2008: Saturn's moons Rhea and Enceladus, and a region of Saturn's rings that includes the tiny moon Pan. Student competitions involved a 500-word essay on the scientific importance of their choice for camera target, and the essays were judged by a panel of Cassini scientists, mission planners, and the JPL education and outreach team. Winners were invited to discuss their essays with JPL Cassini scientists via teleconference. The essay contest generated 197 essays by 289 students, including some homeschooled and special education students.

Across the world, "Scientist for a Day" inspired parallel activities in several countries (including India, Iran, Columbia, Spain, and Sri Lanka). An international version was led by Dr. Carl Murray, imaging team member at Queen Mary, University of London, and involved secondary schools in the underserved borough of Tower Hamlets.

# Johnson Space Center



From the early Gemini, Apollo, and Sky Lab projects to today's Space Shuttle, International Space Station, and Constellation programs, NASA Johnson Space Center (JSC) continues to lead Agency efforts in Human Space Exploration. JSC education serves Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, and Texas.

<http://www.nasa.gov/centers/johnson>

## Higher Education

**Reduced Gravity Education Flight Project** allows teams of undergraduate science and engineering students nationwide to propose, design, and fly a reduced-gravity experiment. To date, student teams from 49 states have flown in this project; these include more than 2,200 undergraduate students from 150 universities, 81 students from 9 community colleges, and 446 high school students from 73 schools.

**Career Exploration Project (CEP)** is a competitive student employment project that provides opportunities for both high school and college students to receive rich on-the-job training experiences supporting NASA's mission and encouraging educational advancement and academic achievement. Tier 1 high school students work part-time during their senior year in high school and the summer following graduation. Tier 2

undergraduate students work part-time while pursuing a four-year degree at a local college or university.

**Texas Aerospace Scholars (TAS) Early College** attracts outstanding students from all ethnic, racial, and social backgrounds. The project seeks to recruit talented students in academic disciplines relevant to NASA's mission. Interested students must be TAS alumni, which encompasses former student participants of High School Aerospace Scholars (HAS) and Community College Aerospace Scholars (CAS). Qualified applicants must be pursuing an undergraduate degree in a STEM-related degree field. Selected participants will be offered a 15-week, hands-on internship at NASA JSC.

**Community College Aerospace Scholars (CAS) Early College** is an annual aerospace-related experience for community college students and professors throughout Texas and includes Web-based assignments prior to a 3-day visit to JSC where students and professors interact with engineers and scientists while working on team projects. Participants are encouraged to pursue 4-year degrees in STEM-related career fields.

## Elementary and Secondary Education

**High School Aerospace Scholars (HAS) Grade 11** includes interactive Web-based lessons, distance learning, and a residential experience during the summer at JSC. Students from across the State of Texas are selected to participate

by their state legislator through a competitive process. Selected students are Texas residents, U.S. citizens, and currently in their junior year of high school (rising senior) with an interest and aptitude for math, science, engineering, or computer science. Participants are eligible to receive formal recognition for their extracurricular work in the form of a one-year science elective credit toward their respective high school diplomas.

**Middle School Aerospace Scholars (MAS) Grades 6-8 Educators** provides teams of middle school teachers from across the State of Texas an opportunity to participate in a unique professional development project. Teachers spend one week during the summer at JSC learning to integrate NASA resources into their own curriculum. During the following school year, their classes participate in a series of distance learning events hosted by NASA. The summer workshop is funded by the MAS project with no costs to the teachers or school districts.

## Johnson Space Center Education Highlights

### **Systems Engineering Educational Discovery Takes Flight.**

In 2008, JSC offered its first-ever nationwide solicitation of student applications aimed at addressing systems engineering challenges within microgravity and lunar gravity environments. Unlike the traditional reduced gravity flight project where students propose the research to be carried out, the NASA technical workforce identified ongoing projects that are systems engineering and reduced gravity-related. Selected student groups were then paired with NASA research projects under the leadership of a NASA Principle Investigator to carry out scientific research, hands-on investigational design, test operations and education/public outreach activities.

In addition to student involvement, one university/college faculty member was invited to fly with each team. This provided faculty members with teaching materials for their classroom that will increase student interest in systems engineering.

**On a Mission to Success.** Adolfo Cortez is an example of the Career Exploration Project's success in advancing students through educational work-study experiences into careers benefiting the future of space exploration. As a high school senior, he was excited about the opportunity to work at NASA even though he planned to pursue a business degree. However, a tour of JSC's Mission Control Center inspired him to consider a different career path. He graduated from high school with honors and earned a full-tuition scholarship to attend San Jacinto College, where he began his pursuit of an engineering degree.

During fall 2008 he transferred to Texas A&M University to pursue electrical engineering. He will be the first in his family to graduate with a college degree. His work experience at NASA

was his employment, and his continued job experience through JSC/Universities Space Research Association work-study programs has dramatically shaped his education and career goals. Upon completing his education, he plans to move back to Houston and pursue his new dream of becoming a NASA astronaut.

**JSC Celebrates "Bring our Children to Work Day."** Amid the normal hustle and bustle at JSC on June 12, 2008, minivans full of children pulled up to the Center to get a close-up look at their parents' workplace during the annual "Bring our Children to Work Day." The event, sponsored by the JSC Office of Education, celebrated the contributions that all employees make to JSC work environment. Young visitors, ranging from preschool to high school age, were able to experience a day in the life of an employee. Special presentations on astronaut training by NASA astronaut Dottie Metcalf-Lindenburger, as well as spacesuits and space food, were scheduled throughout the day. Additional events, such as a visit from PBS character Clifford the Big Red Dog, and opportunities to visit a new Exhibits Trailer on the Constellation Program, further enhanced the visitors' experience.



# Kennedy Space Center



NASA Kennedy Space Center (KSC) is America's Gateway to the Universe—leading the world in preparing and launching missions around the Earth and beyond. KSC education serves Florida, Georgia, Puerto Rico, and the Virgin Islands.

<http://www.nasa.gov/centers/kennedy>

## Higher Education

**Community Outreach Projects in Education (COPE) Higher Education** encompass a broad array of projects and activities to educate higher education students and faculty. The majority of the activities are local and customer-driven. Students, faculty, and education institutions have numerous requests for NASA educational information and assistance. Some requests are spontaneous, some recur each year, and some result in the development of sustainable, repeatable programs.

**Kennedy Intern Project (KIP) Higher Education** is managed by KSC's Human Resource Office. KSC's Education Office supports KIP in order to integrate education and human resource projects. KIP is intended to attract students pursuing degrees in KSC-identified competency areas for work during an academic term. The objective is to provide students valuable work experience related to their academic studies and knowledge of KSC's mission. The project also provides KSC an opportunity to evaluate the student's suitability for participation in the Co-op Program or full-time employment upon graduation.

## Elementary & Secondary Education

**NASA Education Exploration Team (NEET)** is a partnership between KSC and SOMD to provide NASA STEM content to regional/national educators and students. NEET is comprised of two components, the Educator Resource Center (ERC) and the Exploration Station (ES) located in the Center for Space Education (CSE) at KSC. NASA ERCs provide expertise and facilities to help educators at all levels access and utilize science, mathematics, and technology instructional products that are aligned with national standards and state frameworks and based on NASA's unique mission and results. The Exploration Station offers free educational and interactive student programs for school groups as well as other student organizations, and provides hands-on STEM learning activities.

**Community Outreach Projects in Education (COPE) Elementary and Secondary Education** encompass a broad array of projects and activities to inspire and engage elementary and secondary education students and teachers. The majority of the activities are local and customer-driven. Students, teachers and education institutions have numerous, diverse requests for NASA educational information and assistance. Some requests are spontaneous, some recur each year, and some result in the development of sustainable, repeatable programs. COPE activities are often participants' first interaction with NASA KSC and allows them to enter the NASA education pipeline.

**Kennedy Intern Project (KIP) Elementary and Secondary Education** is modified for elementary and secondary students. The program also provides KSC an opportunity to evaluate the

student's suitability for participation in other NASA education or human resource projects.

## Informal Education

**Community Outreach Projects in Education (COPE)—Informal Education.** The KSC Center-unique Community Outreach Programs in Education (COPE) encompass a broad array of programs and activities. The majority of the activities are local and customer-driven. Civic groups, local residents, and informal education organizations have numerous, diverse requests for NASA educational information and assistance. Some requests are since requirements, some recur each year, and some result in the development of sustainable, repeatable projects. COPE activities are often the segment of the pipeline through which participants move from informal to formal programs.

## Kennedy Space Center Education Highlights

**NEET Engages Thousands.** NASA Education Exploration Team (NEET) is comprised of the Educator Resource Center (ERC) and the Exploration Station (ES). The KSC ERC has established strong partnerships with KSC's Education Office, NASA's Space Operations Mission Directorate (SOMD), and NASA's Office of Education. In 2008, approximately 4,826 educators participated in professional development workshops at the ES, and 8,248 educators visited the ERC to receive information on NASA resources. KSC's ERC team also conducted more than 300 K–12 student activities reaching approximately 18,328 students. The team supported numerous informal educational activities that educated over 8,500 students on STEM topics.

**Florida Governor's School Pilot Project.** The State of Florida has given three universities—Florida Institute of Technology, Embry-Riddle Aeronautical University, and Florida State University—funds to plan and test a pilot governor's school of math and science for gifted students during summer 2008.

From June 1–6 and June 29–July 4, KSC, in collaboration with Space Florida and these three universities, hosted two, one-week sessions for 16 gifted students. The students were selected from around the state.

Participants were from the following counties: Bay, Brevard, Broward, Calhoun, Charlotte, Clay, Columbia, Duval, Escambia, Flagler, Gilchrist, Hardee, Hillsborough, Lee, Leon, Marion, Miami-Dade, Monroe, Orange, Palm Beach, Pasco, Pinellas, St. Johns, St. Lucie, Seminole, Sumter, Suwannee, and Volusia.

Delaware North Park Services of Spaceport, a commercial company that operates the KSC Visitor Center, Space Florida, the principal organization charged by the Florida legislature with promoting and developing Florida's aerospace industry, and KSC are providing intensive STEM activities for the students. NASA engineers and senior managers are involved in each week's activities, and students will also work in KSC laboratories.

**2008 DuPont Challenge.** The DuPont Challenge Science Essay Competition began in 1986 and is sponsored by the DuPont Center for Collaborative Research & Education in cooperation with NASA KSC, National Science Teachers Association (NSTA), and Walt Disney World Resort. It honors the memory of the crew of the Space Shuttle Challenger STS-51L mission and all who work to encourage the next generation to explore the frontiers of science.

The 2008 DuPont Challenge award ceremony took place in the Debus Conference Facility at the Kennedy Space Center (KSC) Visitor Complex. NASA guest speakers and hosts included James Hattaway, KSC Associate Director for Business Development, who welcomed the group and introduced keynote speaker Kelvin Manning, manager of the Orion spacecraft for KSC. The Orion Capsule is the crew exploration component of the Constellation Program, which is developing the next generation of spacecraft for human spaceflight. The DuPont Challenge is a prominent student science and technology competition in North America. The competition's objective is to increase scientific literacy among students and to motivate students to excel in communicating scientific ideas. It also recognizes the invaluable role of science teachers in motivating students to communicate scientific ideas through writing.

# Langley Research Center



NASA Langley Research Center (LaRC) continues to forge new frontiers in aviation and space research for aerospace, atmospheric sciences, and technology commercialization to improve the way the world lives. LaRC education serves Kentucky, North Carolina, South Carolina, Virginia, and West Virginia.

<http://www.nasa.gov/centers/langley>

## Higher Education

**NASA Langley Aerospace Research Summer Scholars (LARSS)** Project is managed for NASA by the Virginia Space Grant Consortium (VSGC) under the auspices of the National Institute of Aerospace (NIA). LARSS provides paid internship opportunities for eligible students during spring, summer, or fall sessions. Participants gain exciting hands-on research experience while working side-by-side with NASA LaRC scientists and engineers who serve as mentors.

**Virginia Aerospace Science and Technology Scholars (VASTS)** is a partnership between LaRC and the Virginia Space Grant Consortium. The project, which targets high school

juniors, engages students in an interactive 10-week distance learning course. The NASA-developed coursework uses a Space Exploration theme to teach a broad range of STEM skills aligned with state and national standards of learning. Students who successfully complete the coursework will attend a six-day residential summer academy at LaRC.

**Preservice Teacher Project (PSTP)** is a two-week, residential summer STEM institute and an annual, two-and-a-half day, national professional STEM development conference. The conference and institute are designed to stimulate prospective grades 4-8 teachers' (and their university advisors') interest, knowledge, and confidence in developing new strategies for team teaching an inquiry-based, integrated, STEM Curriculum with a focus on systemic change.



## Langley Research Center Education Highlights

**College Students Design Future Aircraft In NASA Competition.** Sixty-one students from fourteen colleges and universities around the globe have imagined what the next generation of airliners and cargo planes may look like. Fourteen teams and two individual students submitted their designs in the annual competition sponsored by NASA's Fundamental Aeronautics Program, part of the Agency's Aeronautics Research Mission Directorate.

"The Nation's air transportation system is under tremendous pressure to increase performance and capacity without causing additional damage to the environment," said Juan Alonso, director of the Fundamental Aeronautics Program. "Through competitions such as this, we are nurturing a new generation of engineers who can deliver the solutions we so desperately need."

The contest challenged students to create a future subsonic transport aircraft that could carry up to 50,000 pounds, operate on runways between 1,500 and 3,000 feet long, and cruise at speeds between 595 and 625 mph—about the average speed of airliners today. The competition also stressed that concept planes should use alternative fuels and be quieter and more environmentally friendly than today's commercial fleet.

The highest scoring graduate team was from Georgia Tech in Atlanta and undergraduate team honors went to Virginia Tech in Blacksburg, Virginia.

**Virginia High School Juniors Experience Exploration.** Forty-eight Virginia Aerospace Science and Technology Scholars (VASTS) attended a week-long immersive summer academy at NASA Langley Research Center July 27 – August 1, 2008. These dynamic high school juniors from throughout Virginia were actively engaged with NASA scientists, engineers, and technologists during the Academy. Beginning in April, the scholars participated in a NASA-developed distance-learning course with a space exploration theme. The 10-week course covered a broad range of STEM skills aligned with state and national standards of learning. The project seeks to broaden students' STEM knowledge while providing meaningful, real-world experiences and career role models in the aerospace sector. During the summer academy, scholars were divided into four teams to plan a mission to Mars: getting there, living there, working there, or mission integration. VASTS is a partnership between NASA LaRC and the Virginia Space Grant Consortium, and is modeled after the highly successful, NASA award-winning Texas Aerospace Scholars program developed by JSC.

### **Aeronautics Competition Places Two Students at LaRC.**

Alex LePage and Nicholas Heinz worked as summer interns in the Langley Aerospace Research Summer Scholars (LARSS) Project. Their internships were awarded by the annual university student competition, Fundamental Aeronautics Program, part of the ARMD at NASA Headquarters. The contest placed interns at all of NASA's aeronautics research centers.

For the contest, 16 teams from around the globe submitted designs for a futuristic subsonic fixed-wing aircraft. Heinz, a rising senior at the University of Miami, was part of a four-member team that won second place. LePage, a senior at the University of Central Florida, was part of a two-member team that won an honorable mention.

As part of the subsonic fixed wing project, Heinz and LePage work alongside NASA engineers to study the structural design of an experimental blended wing body aircraft. The LARSS project served 156 students in summer 2008.

# Marshall Space Flight Center



Bringing people to space, bringing space to people. MSFC is world leader in the access to space and use of space for research and development to benefit humanity.

NASA and MSFC strive to help maintain a strong American education system, nurturing students' interest in the fields of mathematics and science from elementary school through their college years, and encouraging young people to consider careers in engineering and the aerospace industry. We also forge strong ties with the Nation's academic centers of excellence and the educators who anchor the field of learning. Our main goals are to inspire and motivate students to pursue STEM careers and to engage the public in shaping and sharing the experience of exploration and discovery. MSFC education serves Alabama, Arkansas, Iowa, Missouri, Louisiana, and Tennessee.

## Higher Education

**Cooperative Education/Recruiting.** The Cooperative Education Program at MSFC is open to Ph.D., graduate, and undergraduate students from around the country who alternate semesters at school with semesters at MSFC working in a paid, full-time position directly related to their field of study in cooperation or support of NASA's Mission Directorates.

## Elementary and Secondary Education

**Workforce Coalition: Education Task Force.** In 2006, MSFC transitioned leadership for the Integrated Stakeholder Coalition for Workforce Development (ISCWD) to the Huntsville/Madison County Chamber of Commerce's Workforce Coalition. The MSFC Academic Affairs Office now leads the Education Task Force subcommittee of the Workforce Coalition to focus on K-12 education initiatives identified by the Workforce Coalition. The Task Force utilizes a systems approach to engage community stakeholders in facilitating partnerships to build skills needed for the workforce.

**MSFC Educator Resource Center Network.** The Marshall Space Flight Center Educator Resource Center Network (MSFC/ERCN) consists of centers located in the states of Alabama, Arkansas, Iowa, Louisiana, Missouri, and Tennessee. Each Educator Resource Center (ERC) demonstrates and facilitates the use of educational technologies; provides in-service and pre-service training utilizing NASA curriculum support products; and partners with local, state and regional educational organizations to become part of the systemic initiatives in the state.

## Marshall Space Flight Center Education Highlights

**Visiting Researcher Exchange and Outreach (VREO).** The Visiting Researcher Exchange and Outreach (VREO), instituted in May 2001, is a MSFC project managed through a cooperative agreement between its Academic Affairs Office and the Universities Space Research Association (USRA). VREO facilitates the process of establishing on and off-site working relationships between university, private sector, and Government agency researchers and NASA scientists, engineers, and technologists. Visiting researchers with contracts during the period of October 2007 through September 2008 included five scientists, engineers, and distinguished senior researchers, one K-12 teacher, three college faculty, and six undergraduate and three graduate students. VREO's outreach component facilitates the exchange of scientific, engineering, and technical information between NASA and external partners through the coordination of seminars, meetings, workshops, and colloquia. The benefits of tapping into the knowledge base that resides within academia and industry are two-fold, with both sides reaping benefits from the collaboration.

**Task Force Provides Career Focus to Middle School Students.** In 2007, MSFC's Academic Affairs Office began leading the Education Task Force, a sub-group of the Huntsville/Madison County Chamber of Commerce's Workforce Coalition. The Coalition recognized that education-to-workforce partnerships should provide experiential/hands-on, problem-solving skills and career focus in real work-world environments. During the 2007-08 academic year, the Education Task Force implemented the Career Tech/Cluster Initiative in four local pilot middle schools. MSFC's Academic Affairs Office collaborated with Junior Achievement of North Alabama to engage students and teachers in classroom career cluster activities and real work experiences at industry sites. To insure sustainability, work site visits were followed by STEM and healthcare

interactive activities, including NASA Digital Learning Network (DLN) career modules, space exploration presentations, and bio-tech/DNA experiments at the pilot schools. Also, the participating educators took part in professional development at the MSFC Educator Resource Center, and through work site visits and shadowing tours/mentorship at industry sites.

**INSPIRE Students Provide Educational Opportunities at Huntsville International Air Show.** NASA's Interdisciplinary National Science Project Incorporating Research and Education (INSPIRE) brings unique education and work experiences to students. The INSPIRE students at MSFC became the teachers when they guided educational activities for children at a local air show in the summer of 2008. This was an opportunity for students in the NASA workforce pipeline to reach out to others who may potentially be interested in NASA's education projects or future employment.

The INSPIRE students participated in training sessions prior to the event and gained knowledge on propulsion terminology and facts. They then used their newly acquired skills to demonstrate straw rockets to hundreds of air show participants. It was a fun and unique way to "inspire" future education participants using NASA-unique aerospace content against the backdrop of an air show.



# Stennis Space Center



Stennis Space Center (SSC) is responsible for NASA's rocket propulsion testing and leads the Agency's research effort in coastal management issues involving the northern Gulf of Mexico. SSC education serves Mississippi.

<http://www.nasa.gov/centers/stennis>

## Higher Education

SSC offers opportunities to visiting scholars and students from around the country. This includes the full array of national fellowships, grants, and internships available through the Agency and Space Grant consortia. In addition, SSC annually hosts the Pre-Service Teacher Institute (PSTI).

The Pre-Service Teacher Institute (PSTI) is an intensive, two-week summer residential session for college students who are preparing to teach elementary or middle school. College students from diverse backgrounds spend a dynamic and exciting time at a NASA Space Center where they are exposed to problem-based learning, mathematics and science enrichment activities, and specific NASA missions and technologies.

## Elementary and Secondary Education

SSC works to increase awareness of the U.S. Space Exploration Policy with Mississippi and Louisiana educators and students. The SSC Educator Resource Center (ERC) uses STEM curriculum materials to engage the education communities of the Mississippi Band of Choctaw Indians and the Gulf Coast Education Initiative Consortium, along with other schools in the area. Activities include educator professional development workshops, hands-on student activities and new teacher orientations. NASA facilitators base activities on local curriculum requirements, Mississippi curriculum frameworks and national education standards.

Stennis Space Center is a strong supporter of FIRST (For Inspiration and Recognition of Science and Technology) Robotics and LEGO League (FLL). SSC hosts the FLL Mississippi Championship Tournament, helps host the FIRST Bayou Regional Robotics Competition, and provides volunteers, mentors, and judges for robotics competitions. In the past three years, NASA has provided over \$1 million in grants and support to local schools and regional robotics committees.

## Informal Education

Astro Camp at SSC introduces thousands of children to NASA, space flight, and STEM. The camps include Saturday camps and week-long summer camps for students ages 7–15. A traveling Astro Camp provides stimulating educational activities to thousands of people at events across the United States.

Astro Camp students learn principles of propulsion and spaceflight through exciting, hands-on projects including rocket launches, egg drops, neutral-buoyancy exercises, and much more.

Astro Camp Plus, a special camp for 13–15 year-olds, emphasizes technology. As NASA prepares to send humans back to the Moon and on to Mars, campers join in the excitement by learning about the different goals and assignments it takes to make the space program a success. Counselors work with campers on team projects and games that teach science and math principles as they inspire future scientists, engineers, and astronauts to follow their dreams.

## Stennis Space Center Education Highlights

### **Rocketry and Space Exploration Day for Area Girl Scouts.**

SSC has historically provided a variety of informal education opportunities for Mississippi Girl Scouts. In October 2007 nearly 150 Brownies participated in NASA Brownie Day at SSC. The girls explored hands-on activities related to astronomy, rocketry, and space exploration. NASA curriculum materials were used to support STEM concepts for the girls to earn their Earth and Sky, and Space Explorers Try-It Badges for Brownies

In May 2008, Mississippi Junior Scouts and leaders participated in an Aerospace Train-the-Trainer. This event was the first step in preparing the Scouts and leaders for conducting their own Girl Scout Aerospace Badge events. During the training, participants utilized NASA curriculum to learn hands-on activities in aeronautics, propulsion and space travel. This will be further reinforced during a Junior Aerospace Badge event during 2008, in which the trained scout will facilitate the content previously learned. By empowering the girls with knowledge and confidence, SSC is providing them with a foundation to succeed.

**SSC Champions FIRST LEGO League.** Since 2001, the Stennis Space Center education team has championed robotics education programs for elementary and middle school students in Mississippi. A cornerstone of this endeavor is the Center's support for Mississippi FLL. FLL is a science and technology competition for teams of ten students or less. Each year, students are required to design and build a LEGO robot to complete autonomous missions on a playing field. The team must also conduct and present original research about a scientific problem.

SSC is the primary sponsor of FLL tournaments in Mississippi, providing staffing, logistic and material support to students, teachers and mentors. In December 2008, 31 teams and more than 300 students participated in the Mississippi Championship Tournament. This was the largest FLL event ever in Mississippi, with 14 different school districts and 3 home school organizations represented. Through SSC's efforts, the Mississippi FLL program has experienced phenomenal growth (more than 300 percent in the past 3 years). Statewide, students have had the opportunity to participate in a truly unique program that celebrates STEM.

### **NASA-Honeywell FMA Live! Partnership Reaches Thousands.**

NASA SSC has reached over 1500 middle school students and teachers through FMA Live! FMA Live! is an innovative and dynamic stage show that uses live actors, music, and video to teach Newton's Laws of Force and Motions, that is the result of a strategic partnership between NASA and the Honeywell Corporation. The show tours throughout the United States during the school year.

In addition to bringing FMA Live! to Mississippi, SSC worked with Mississippi State University to host the event in its coliseum, thus enabling students from all over North Mississippi to attend. The production was highly successful, and SSC is already working with Honeywell and Mississippi State University to host a two-day FMA Live! in 2009. FMA Live! is a collaboration between NASA and Honeywell International, Morris Township, NJ.

# NASA Education Goals and Framework

In 2006 and beyond, NASA will continue to pursue three major education goals:



## Strengthening NASA and the Nation's future workforce

NASA will identify and develop the critical skills and capabilities needed in aeronautics, Earth and space science, and space operations to ensure achievement of the U.S. Space Exploration Policy. To help meet this demand, NASA will continue contributing to the development of the Nation's science, technology, engineering, and mathematics (STEM) workforce of the future through a diverse portfolio of education initiatives that target America's students at all levels, especially those in traditionally underserved and underrepresented communities.



## Attracting and retaining students in STEM disciplines

NASA will pursue the minds, imaginations, and career ambitions of America's youth. The Agency will focus on engaging and retaining students in STEM education programs to encourage their pursuit of educational disciplines critical to NASA's future in aeronautics, Earth and space science, and space operations and for participation in engineering, scientific, and technical missions.



## Engaging Americans in NASA's mission

NASA will build strategic partnerships and linkages between STEM formal and informal education providers. Through hands-on interactive educational activities, NASA will engage students, educators, families, the general public, and all Agency stakeholders to increase Americans' science and technology literacy.

## The Guiding Education Strategic Framework

The Education Strategic Coordination Framework is an Agency portfolio approach to education that builds upon the above education goals that were identified in the Agency 2006 Strategic Plan. It aligns NASA's total education portfolio with the strategic plan; provides a coordination structure; and creates an Agency-wide strategic planning, implementation, and evaluation framework for the Agency's investments in education.

NASA delivers this comprehensive portfolio through its Office of Education, Mission Directorates, and Field Centers, and contributes to our Nation's efforts in achieving excellence in STEM education.

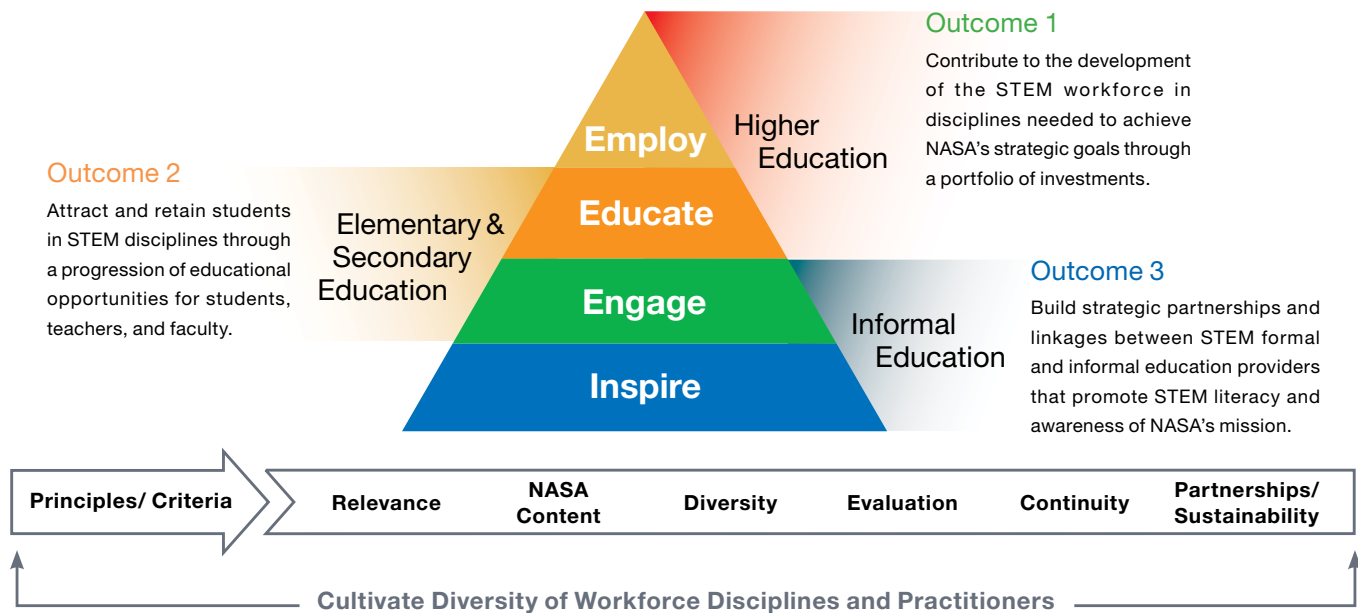
The Education Strategic Framework chart depicted in Appendix B provides a conceptual basis for examining, guiding, and coordinating the NASA education portfolio. It is a strategic management tool that allows the Agency to monitor participant movement through education activities, with each category leading to the next. Education programs and projects draw from the category below them as a key source for participants, and they connect participants to the category above them, providing a more experienced and focused group, and creating a measurable pipeline.

More information about the NASA Education Strategic Framework can be found at <http://education.nasa.gov/about/strategy/>



# NASA Education Strategic Framework

## A Clearly Defined and Coordinated Portfolio Approach



**Overarching Philosophy (Cultivate Diversity):** The cultivation of diversity is both a management philosophy and core value for all NASA education efforts. Diversity of the skills and talents needed in our future workforce is critical to our success. Potential at both the individual and organizational levels will be maximized by fostering awareness, understanding, and respect for individual differences. The knowledge, expertise, and unique background and life experiences—including ethnicity, gender, race, religion, and cultural identity—of each individual strengthen the Agency.

**Relevance:** To effectively strengthen the Nation's STEM workforce, NASA must implement activities that are useful to the education community and that enhance its ability to engage students in the STEM pipeline.

**Content:** Education investments use NASA content, people, or facilities to involve educators, students, and/or the public in NASA science, technology, engineering, and mathematics.

**Diversity:** NASA strives to ensure that underrepresented and underserved students participate in NASA research and education programs to encourage more of these students to pursue STEM careers. Programs and projects are representative of American demographics; engage underrepresented and underserved minorities, women, and persons with disabilities; and reflect an atmosphere of equity, balance, and inclusiveness. NASA will continue to focus on enhancing the capabilities of Minority Serving Institutions to contribute to the research needs of the Agency.

**Evaluation:** Education investments document their intended outcomes and use metrics to demonstrate progress toward and achievement of these outcomes and of annual performance goals. Evaluation methodology is based on reputable models and techniques appropriate to the content and scale of the targeted activity, product, or program.

**Continuity:** Projects and activities draw from audiences who have already demonstrated interest in NASA and connect participants to the next level of engagement. A blend of projects and activities encourages continued student affiliation with NASA throughout their academic careers.

**Partnerships/Sustainability:** Education investments leverage and achieve sustainability through their intrinsic design and the involvement of appropriate local, regional, and/or national partners in their design, development, or dissemination. As appropriate, key aspects of projects and activities are replicable, scalable, and demonstrate potential for continuation beyond the period of direct NASA funding.

# NASA Education Categories of Involvement

## Four Categories of Involvement

### **Inspire**

Activities focused on promoting awareness of NASA's mission among the public, primarily through informal education and outreach activities. This category is heavily supported by the outreach activities of other NASA organizations, such as the Office of Public Affairs. Inspire-level efforts are broad, with the goal of reaching a large number of people. This category forms the base of an education structure that becomes more focused at progressively higher levels of the framework pyramid.

### **Engage**

Education activities that in some manner incorporate participant interaction with NASA content for the purpose of developing a deeper understanding. Participants are strategically identified and targeted.

### **Educate**

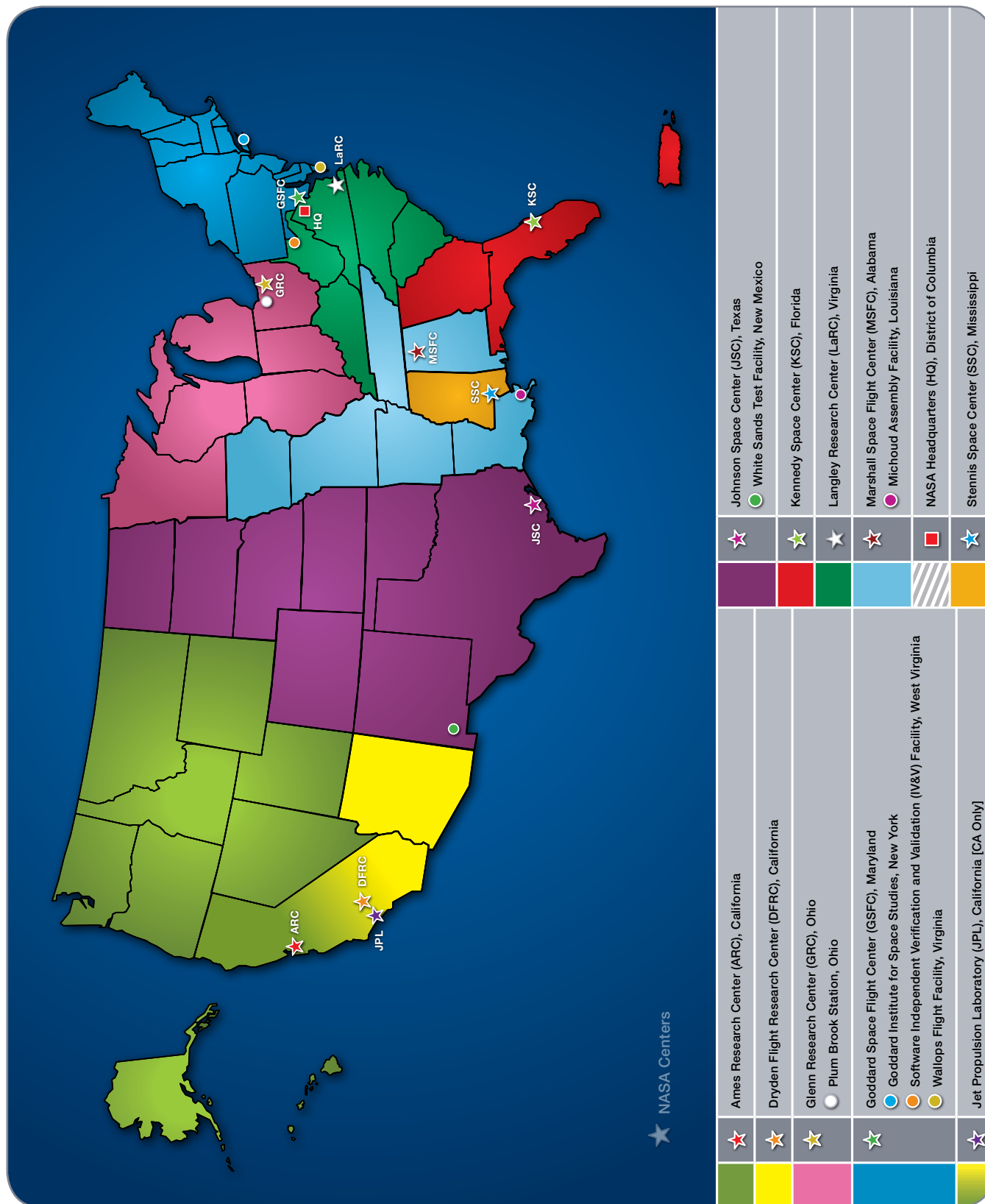
Focused education support that promotes learning among targeted populations. Education activities focus on student learners or pre and inservice educators and are designed to develop and/or enhance specific STEM knowledge and skills using NASA resources. These activities promote new knowledge acquisition and strengthen an individual's skills. NASA's elementary and secondary education efforts are supplementary to formal classroom instruction. NASA's higher education efforts may include development of specific university curricula in support of the NASA mission and student-built instruments.

### **Employ**

Targeted development of individuals who prepare for employment in disciplines needed to achieve NASA's mission and strategic goals. Through internships, fellowships, and other professional training, individuals become participants in the Vision for Space Exploration and NASA science and aeronautics research. At the apex, they have acquired sufficient mastery of knowledge for employment with NASA, academia, industry, or within STEM fields of teaching.



# NASA Education K-12 Service Areas





## For More Information

For more information, please visit [www.nasa.gov](http://www.nasa.gov).

The NASA Web Site is the single point of entry to NASA public content and the most popular Government site on the Web. It serves as the gateway for information regarding content, programs, and services offered by NASA for the general public and, specifically, for the education community.

Visit [www.nasa.gov](http://www.nasa.gov) to find out more information about NASA's mission, research, and activities; NASA Education strategy and programs; and NASA Mission Directorates and Field Centers.





“NASA’s pursuit of discovery pushes the extremes of science to answer fundamental questions about who we are and where we come from; to achieve a greater understanding of the universe; and to determine what is happening to the Earth’s climate and why. These discoveries... serve to whet the appetite of future generations and inspire them to push further the ever-expanding frontiers of human understanding.”

—NASA Deputy Administrator Shana Dale

<http://www.nasa.gov/education>



inspire engage educate employ . . .  
the next generation  
of explorers and innovators.